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UNIVERSITIES AND THEIR FUNCTIONS.

BY THE EDITOR.

THERE is so much interesting, so much human to dwell upon in the *Occasional Addresses* of Mr. Asquith that it would take more space than can legitimately be given to it in the pages of this *Journal* (Messrs. Macmillan & Co., 6s. net). But there are certain portions of the book which deserve to be referred to in the interests of University education in this country. These refer directly or indirectly to Education and to these we would direct special attention in this review of an eminently good book. The fountain of wisdom flows through this book pure and clear. The addresses it contains show Mr. Asquith to great advantage. Mr. Asquith's knowledge of books, it is seen, is great; but it is clear it has not diminished to any extent his knowledge of the world. Mr. Asquith's views on the subject of University Education are to be found in different addresses delivered by him during the past twenty-five years, though in one of them—the Rectorial Address delivered before the University of Glasgow in 1907—he touches on most of them. To some of the ideas he gives expression to in this address he recurs in one or two others, notably in his Rectorial address before the University of Aberdeen and in his Presidential Address delivered before the Classical Association.

In his Glasgow Address, Mr. Asquith touches on the origins of the Universities of Oxford and Cambridge and in doing so refers to one or two points to which attention may be invited here. The Mediæval Universities were, he says, cosmopolitan in composition and catholic in their range. The first of these characteristics, he illustrates in vivid terms. "There were," he says, in the Mediæval Universities "no barriers of birth or class or fortune. The door was open to all. Just as the Church was one and indivisible, speaking one language, holding one creed, observing the same rites throughout Western Europe, so, in the community of students and scholars, there was a oneness of purpose and a comradeship of speech and habit which transcended, though it did not obliterate, racial and geographical distinctions. The Scottish students, long before any University had been planted in their own soil, swarmed over Europe. They were to be found in Paris, where they had a separate College; in Padua, where they had a Nation to themselves; and in almost all the academic towns of France, Northern Germany, and of the Low Countries. Scholars flocked to Oxford in the days of William of Ockham and Roger Bacon from every part of the Western World. The University of Bologna, at the time when it held the first place among the schools of Civil and Canon Law, is said to have had no less than 20,000 students from different countries." The Scottish Universities, national as in a peculiar sense they have always been, have in their turn—Mr.

Asquith reminds—exercised the same hospitality, and have found room for outsiders to whom Providence denied the privilege of being born on Scottish soil. When Adam Smith lectured at Glasgow in the middle of the Eighteenth Century quite a third of the class were (says Mr. Asquith) Irish dissenters shut out by religious tests from their own Trinity College and his fame attracted students, not only from England, but from Geneva, and even from Russia. "A less liberal policy prevailed," adds Mr. Asquith, "in those days, not only in Dublin but in Oxford and Cambridge, whose splendid endowments and great traditions were in danger of becoming—though they never in fact became—the exclusive property of a limited class. *Cuncti adsint* is the invitation addressed now as always, to the world of students by every University that is worthy of the name." In India, the Universities have always followed the British traditions and it is worthy of note that even in ancient days the idea of shutting out students because of their religious beliefs was unknown in this country.

Referring to the other characteristic of a University, Mr. Asquith says that the true University has been not only cosmopolitan in composition but also catholic in its range. "A University such as yours," he tells the students of Glas gow, "never was, is not, and never ought to become a technological institute for the creation and equipment of specialists. The modern student may smile at the scanty proportions of the mediæval *trivium* and *quadrivium*. He may be tempted to scoff at the pettiness and futility of many of the problems upon which in those days Angelic and Invinicible Doctors broke their teeth. The Latin of the Schoolmen is no doubt an uncouth jargon which smacks more of the Vulgate and the Corpus Juris than of Cicero or Livy. Their dialectics are monotonous and infertile, not because of any defect in their reasoning powers, or indeed in their logical apparatus, but because they were hedged in, both by authority and by ignorance, within the narrow boundaries of a single field. But whatever, within its confines, was knowable, they knew. It was said of Abelärd, the forerunner of them all: *Illi patuit quciquid scibile erat.* The limits of the knowable —wherever they are to be placed—have in these days expanded so far that no ambition and no assiduity is equal to the task of taking all that lies within them for its province. Nothing can be more alien from the business of a University than to produce the shallow and fluent omniscience which has scratched the surface of many subjects, and got to the heart of none. But the fidelity of a University to the intellectual side of its mission must now, as always, be judged by the degree in which it has succeeded in enlarging and humanising tbe mental outlook of its students and developing the love of knowledge for its own sake." Such an ideal as this, Mr. Asquith points out, does not imply a divorce of knowledge from practice. He instances, with telling effect, the truth of this observation by referring to the work of James Watt and Adam Smith who both belonged to Glasgow University. "It is often," he adds, "at the mouths of professors, and at the hands of Universities, that the practical man learns for the first time the real meaning and the latent possibilites of his own business. Statesmen and financiers and industrialists have never received two more magnificent presents than the *Wealth of Nations* and the *Steam Engine* and both came from within the walls of the Glasgow College."

A University has the duty cast on it to leave its intellectual stamp on those whom it teaches. That, however, is not, the supreme or ultimate test of its work. "In the long run," says Mr. Asquith, "it will be judged not merely or mainly by its success in equipping its pupils to outstrip their competitors in the crafts and professions. It will not be fully judged even by the excellence

of its mental gymnastic, or its contributions to scholarship and science. It will be judged also by the influence which it is exerting upon the imagination and the character; by the ideals which it has implanted and nourished; by the new sources of faith, tenacity, aspiration, with which it has recruited and reinforced the untrained and undeveloped nature; by the degree in which it has helped to raise, to enlarge, to enrich, to complete, the true life of the man, and by and through him the corporate life of the community." Mr. Asquith reiterates the same idea in his address delivered before the University of Aberdeen (1910). Summing up, he counsels the students: "Keep always with you, wherever your course may lie, the best and most enduring gift that a University can bestow—the company of great thoughts, the inspiration of great ideals, the example of great achievements, the consolation of great failures. So equipped, you can face, without perturbation, the buffets of circumstance, the caprice of fortune, all the inscrutable vicissitudes of life." Judged by this standard, it is a question if any of the modern Indian Universities can be said to have fulfilled their true function. Mr. Asquith's conception of the function of a University was probably realised to some extent by the ancient Universities of India of which we have still a great deal to learn. The little that we do know, however, leads to the inference that they not only set up the highest ideals before their students and by and through them influenced the corporate life of the community. The uniformity in life, ideals and aspirations that we now find in India is to no small extent due to the efficiency with which the ancient Universities of India laboured in the field of education. Their modern descendants have still to discharge this the most essential part of their duty if their work is to prove of any benefit to the people of the country as a whole. In his own inimitable way, Mr. Asquith sketches out the forms of knowledge which it is the prerogative duty of a University to keep alive. This part of his address deserves to be read by every one interested in University education. On that *vexata quaestio* the classics Vs. the sciences, what Mr. Asquith said in 1907 still holds good. The critic might say that much water has flown under the London Bridge since then, but if he serenly considers the position he will find that there is no need to strain the case for the sciences to the detriment of the classics. As Mr. Asquith puts it:—"These are some intelligences which no discipline can convert into accurately working instruments. And those which possess the capacity for being so developed vary as greatly in their structure and tendencies and are therefore as little suited to a uniform regimen, as men's bodies and characters. No one will pretend that they ought all to be treated by the same method unless he is either a quack or possessed by that undiscriminating passion for symmetry, which used to make the Minister for Education in a neighbouring country reflect with complacency that, at a particular minute of a particular hour in the day, every school boy in every school in France was being confronted with the same fact in Roman History." A little later he adds: "The claim I make for them (literary studies) covers much wider ground. The man who has studied literature, and particularly the literature of the Ancient world, as a student should, and as only a student can—I am not speaking of those to whom it has been merely a distraction or a past time—such a man possesses resources which, if he is wise, he would not barter for a king's ransom. He finds among men of like training with himself a bond of fellowship, a freemasonry of spirit and understanding, which softens the asperities and survives the conflicts of professional or political rivalry. He need never be alone, for he can, whenever he pleases, invoke the companionship of the thinkers and the poets. He is always annexing new intellectual and spiritual territory, with an

infinitude of fresh possibilities without slackening his hold upon or losing his zest for the old. There is hardly a sight or a sound in nature, a passion or emotion or purpose in man, a phase of conduct, an achievement of thought, a situation in life—tragic, comic, pathetic or ironical—which is not illuminated for him by association with the imperishable words of those who have interpreted, with the vision and in the language of genuis, the meaning of the world." The case for the study of literature cannot be and has not been put in a more judicious spirit. Applied to our own country, the reasoning of Mr. Asquith leads us to expect a great deal more attention from our Universities to the classics of India so that the advancement of general culture may be rendered possible in it. The study of Sanskrit by every student may not produce all that the study of the classics in England has obtained for Englishmen, but is this any reason why such a study should not be made a *sine qua non* in University education for what it can be easily demonstrated to produce? Have our Universities produced that bond of fellowship, that freemasonry of spirit and understanding that Mr. Asquith refers to? And if they have not, why have they not? Here is something to diagnose, and if possible to remedy.

To another function of the University, Mr. Asquith refers in a passage remarkable for its philosophic insight and literary charm. One cannot do better than quote the passage here. He says:—"Literature, the expression of man's feelings and thoughts, his beliefs and hopes; History, the record of his achievements and his failures; Science, the ever-growing sum of his attempts to know, by hypothesis and experiment, the external conditions which determine his sensations and circumscribe his activity—each of these seemingly isolated efforts of the human intelligence proceeds upon presuppositions which are common to them all. But no student has got the full benefit of University teaching unless he has been led on to examine the presuppositions themselves. We say of propositions that one is true and another is false; and the tests which we are accustomed to empoly as the criteria of truth—conformity to some external standard, self-consistency, adequacy as explanation, congruity with the rest of our experience—vary according to the subject matter with which the proposition deals. But upon what does the validity of any intellectual judgment finally rest? So, again, we say of an act that it is right or wrong, and there is general consensus as to the practical application of the terms. But whence is the authority of the moral imperative derived? And then there emerges, equally insistent, the larger and deeper question still: whether, in the flux of phenomena, there is discoverable by, or revealed to, man any ultimate basis of Reality? These things may not, and do not, trouble the man in the street, but they have supreme interest and urgency for those who take thought seriously. Nowhere do we stand in greater need of courage and honesty: courage, not to shirk problems by trying to believe that they do not exist; honesty in facing solutions, whatever may be their consequences. You cannot get rid of the debt which you owe to yourself and the world as a sentient and self-conscious personality—a "being of large discourse, looking before and after"—by a simple declaration of insolvency."

AGRICULTURE IN TRAVANCORE, 1917-18.

By "RUSTICUS."

TRAVANCORE, though a prosperous and thickly populated State, is yet very little larger than a British district of average size in the adjacent Madras Presidency. It is only fair to the State that this fact should be borne in mind in dealing with the latest Report of its Agricultural Department for it makes the work accomplished by that Department all the more creditable and places the expenditure on it in its proper perspective. Rs. 57,490 which was the expenditure in 1917-18, compares very favourably indeed with the Rs. 3½ lakhs spent on the Agricultural Department in Bihar and Orissa or the Rs. 4 lakhs in Bengal and shews that the State is fully alive to the importance of agricultural development.

It is hardly an exaggeration to say that the prosperity of Travancore depends on the coconut. The products of what is undoubtedly the most useful tree in the world, providing as it does food, drink and shelter, form the bulk of its exports. It is natural, therefore, that the most important work of the Agricultural Department should be on the coconut crop. The Agricultural Chemist is endeavouring to ascertain which varieties give the best yield of copra and oil. Nuts of fourteen varieties were analysed and it was found that the number required to make up 600 pounds of copra varied from 600 to 3,200. The variation in the percentage of oil contained in the copra ranged between 50·4 and 69·1. The Entomologist is engaged in combating the insect pests which attack the coconut palm. Two of these, the rhinoceros beetle and the red palm weevil, though common, are not very serious. The coconut leaf roller, which appeared in and round Quilon in 1917, does much more harm. Fortunately, it can be eradicated by cutting and burning affected leaves and this was done in spite of considerable opposition from the owners of the trees who apprehended the total destruction of their means of livelihood. Their fears were groundless for the trees operated on are now quite healthy and the pest has been almost entirely stamped out. The principal mycological work is a struggle against a disease affecting the roots of the coconut palm. We are not told what it is or whether, as Travancore has no mycologist of its own, the aid of the mycologists at Pusa or Coimbatore has been sought. The methods adopted in dealing with it, which are of the usual character, such as the destruction of infected trees, the segregation of isolated areas of infection, the propagation of disease resistant varieties and so on, are stated to have been successful in stopping the spread of infection. Experiments conducted at various stations show the value of manure when applied to the coconut palm. The net return from manured trees on the farm at Trivandrum amounted to two rupees per tree, the average on ordinary cultivators' lands being not more than half this. The Agricultural Department is making some progress in producing better varieties of coconut palms by hybridization. Crossing in the case of trees is a much slower process than crosses of wheat or cotton and it will be some years before the measure of success achieved can be definitely ascertained.

Of the other crops to which the Agricultural Department devoted attention, the most important were paddy, sugar-cane and tapioca. No work seems to have been done on pepper or cardamoms, though the exports of these from Travancore are far from negligible. Efforts to evolve superior strains of paddy by hybridization and crossing are being made but none of the strains produced has got beyond the trial stage. The economic planting of paddy seedlings either singly

or in twos or threes has spread so rapidly all over the State that it is no longer possible to estimate the area in which it has taken the place of the old wasteful method of planting eight to ten in a bunch. Had the Agricultural Department in Travancore nothing else to its credit, this alone would have justified its existence. The area under sugar-cane in the State is increasing and, in one taluk alone, 1,000 acres of virgin forest are being broken up for cultivation. The Department is introducing the red Mauritius cane and distributed 50,000 sets, sufficient, however, for five acres only during the year.

Stimulated thereto by the rise in the price of cloth and the difficulty in obtaining yarn from outside, the Department gave out seed of Cambodia cotton and of the improved Tinnevelly varieties. This appears to us an unwise step. The Director of Agriculture is doubtful whether the climatic and soil conditions of Travancore are suitable for cotton cultivation. In any case, we cannot but regard the distribution of seed of a crop or variety before its suitability to local conditions has been thoroughly tested by the Agricultural Department as an unfortunate reversion to an old bad policy.

Travancore has a small cattle farm but the Director of Agriculture sorrowfully admits that, until the number of cattle on it increases beyond the present total of 371, no progress in the introduction of improved breeds of cattle can be expected.

There are, if we recollect correctly, few parts of India in which the proportion of literates is higher than it is in Travancore. It is, therefore, all the more surprising that agricultural education has made so little headway. All that is done at present is to teach elementary agriculture in the top three classes of the vernacular schools. The Agricultural Department is carrying on a praiseworthy work in conducting night schools for agricultural labourers belonging to the depressed classes. There are now three of these with fifty-two students who have been given a grounding in the "three R's." We are told, however, that the progress of the schools is hampered by absence of accommodation, equipment and teachers. The only other essential which could be lacking is students! If the experiment is worth undertaking, as we consider it undoubtedly is, it is worth spending a little money on.

Travancore, like other maritime parts of India, is beginning to realize that it possesses a valuable asset in its fisheries. Two fish-breeding farms were opened at Quilon during the year and the opening of a fish-curing yard at Alleppey has been sanctioned. The work of the Fisheries Branch is only in its initial stage, but the receipts already exceed the expenditure, being Rs. 10,627 against Rs. 10,438.

The value of the co-operative movement in promoting agricultural development is being increasingly proved all over India. Travancore has, we believe, yet to start a Co-operative Department. The mention of the contemplated establishment of a co-operative society for fishermen and the establishment of few seed unions for the distribution of the seed of improved varieties of paddy are straws which show that the healthy blast of co-operation is beginning to blow across the State.

According to the South African Press, an official of the Department of Forests recently visited Johannesburg and exhibited a sample of turpentine extracted from wood in the Orange Free State. The sample seemed to stand the various tests, and inquiry is being made as to the possibilities of production on a commercial scale. A local supply is greatly needed, not only by the polish and blacking factories, which have practically had to suspend work, but also by the paint industries.

INDIGO INVESTIGATIONS AT PUSA.*

BY MR. & MRS. HOWARD,

Imperial Economic Botanists.

1—BOTANICAL.

THE investigations on this crop, referred to in previous reports, have been continued during the year and have been confined largely to Java indigo. As this crop, when grown for leaf, is in the ground for nearly a year, it must be remembered that it differs entirely from the ordinary cold weather and monsoon crops as it has to maintain itself under a very wide range as regards soil conditions. Sown in September or early October, the first portion of the growth period takes place under cold weather conditions. The crop then has to survive the hot season when dry west winds are to be expected after which the temperature of the surface soil rapidly rises. The plant then completes its first year's growth in the monsoon phase, during the latter portion of which the aeration of the soil is interfered with by the cessation of drainage due either to the rise of the rivers, the flooding of the country, the rise in the sub-soil water level or to a combination of these causes. In interpreting the results obtained with this crop, therefore, it will always be necessary to bear in mind these facts. It is generally in the second half of the monsoon and after the first cut has been taken that growth slows down and the plant often becomes diseased.

Much time has been spent in the investigation of the root system of this crop and the effect thereon of any alteration in the soil conditions and also of cutting back to varying degrees. The roots of Java indigo are exceedingly sensitive to undecayed organic matter such as oil cake, fresh *san* hemp (*Crotalaria juncea*) weeds or partially decayed indigo, particularly when these substances are added to the soil at times when the aeration is poor. It is then possible to kill the crop outright by these means. When, however, the damage does not proceed so far, the root system is often profoundly affected, the total absorbing surface is reduced and the young roots and nodules lose their freshness and become discoloured and unhealthy. The above-ground portion ceases to grow normally, and the young branches are frequently attacked by *Psylla*. Similar results have been obtained in the August sown seed crop when the indigo has been sown in land foul with weeds which have been turned under a few weeks previous to sowing.

The effect of complete or partial cutting back on the root system of rapidly-growing Java indigo has yielded some interesting results. In the cultivation of indigo in Bihar it is the universal practice to cut the indigo back completely in June and to leave the stumps for a second crop. The time taken in forming new shoots varies with the season. In very wet weather, sprouting is delayed and the process is distinctly favoured by a break in the rains. It has frequently been observed at Pusa that if a few leaves are left at the first cut, the new growth is much more rapid. This year, the effect of complete cutting back and of hard pruning on the root system was examined. It was found that complete cutting back, while the plant is in active growth, kills the fine roots and nodules and that a new absorbing system has to be produced, before new shoots form. This naturally takes time. Heavy pruning, on the other hand, leads to far less damage to the roots and nodules, which at once explains the rapidity with which such plants form new growth. This fact may easily prove of considerable practical advantage to the indigo industry. If the crop could be grown in double lines with interculture, it could be heavily pruned at the

*Taken from the report for 1917-18.

first cut and the second crop could be advanced by several weeks. A new system of growing Java indigo, based on these results, has been worked out at Pusa. The crop is sown in September (after a clean fallow) in double lines with a space between for mechanical interculture to keep down weeds and to aerate the soil. The lines are pruned as early as possible after the raius break and the second cut is taken as soon as possible afterwards. Whether it will be better to be content with this second cut and then dig out the stumps or to prune a second time and try to obtain a third and final cut, is a matter which further experience will decide. The results already obtained show that under actual field conditions in the monsoon the pruned plant, grown in double lines, shoots much faster and much better than the completely cut back plant. Further, it is possible in this way to keep the land clean by bullock cultivation during the *rabi* season and the following hot weather and to reduce the labour spent in weeding. As is well known, one of the great drawbacks at the present time of Java indigo cultivation in Bihar is the difficulty and expense of keeping down weeds.

The effect on the growth of Java indigo of an alteration in the soil conditions by the addition thereto of inert aerating agents such as sand or broken bricks and tiles, was investigated by means of the modified system of pot culture described in a paper read at the Indian Science Congress at Lahore. As an example of the kind of results obtained by this method, the following measurements in the case of Java indigo may be cited :—

The effect on the growth of Java indigo of diluting Pusa soil with potsherds or sand.

Kind of soil.	No. of plants measured	Average length in cm.	Percentage increase
Soil only ...	33	36·7	0
soil $\frac{1}{2}$+sand $\frac{1}{2}$ ...	36	51·6	40
Soil $\frac{9}{10}$+patsherds $\frac{1}{10}$.	33	48·3	31
Soil $\frac{7}{10}$+potsherds $\frac{3}{10}$.	35	50·9	38

The results obtained by diluting Pusa soil have been strikingly confirmed during the year by Mr. Clouston who grew the same type of Java indigo under similar climatic conditions at two centres—on the stiff black soils at Tharsa and on the open, porous *bhata* soils at Chandkhuri near Raipur. On the well-aerated, poor *bhata* soils, Java indigo grew with great rapidity and formed good and abundant seed. On the richer but badly aerated black soils at Tharsa, the growth was very poor. These results are illustrated in a paper by Messrs. Clouston and Padmanabha Aiyer read at the Lahore meeting of the Indian Science Congress. A more effective confirmation of our views on the effect of soil aeration and drainage on the growth of Java indigo could hardly be desired. All interested in the welfare of the Bihar indigo industry should carefully study Messrs. Clouston and Aiyer's paper which is published in the Special Indian Science Congress Number of the *Agricultural Journal* of India of 1918. It will be interesting to see what class of colour will be obtained on these *bhata* soils when the Chandkhuri crop is made into indigo.

The results obtained on the production of seed of Java indigo under Bihar conditions were applied on a large scale during the year and very fine samples were obtained, much better than auything imported from Java. The yield was affected by shortage of moisture at the end of the rains and also by the dry winds during the ripening period in February which led to a good deal of loss from the splitting of the pods. For the first time since the shortage of seed of this crop became acute, the supply has been such that the price per maund has fallen very considerably, a result which will probably reduce the quantity of seed grown outside Bihar. The Pusa experiments have proved that good crops of seed can be obtained in Bihar provided the land is well selected and sufficient care is taken in the manuring, cul-

returns are obtained under conditions of garden rather than of field cultivation and it might easily pay some of the estates to devote very special attention to the seed crop on a small area and also to keep in reserve a year's supply in case of floods or unfavourable seasons. The experiments on this subject are being continued as it is expected to raise, under conditions of intensive culture, heavy yields of seed no matter what the season may be. There is little doubt that the sooner North Bihar becomes self-supporting as regards Java seed the better. As the crop is not uniform but consists of a mass of heterozygotes, differing widely in root development, it is not safe to rely on seed produced under quite different soil conditions. The result of growing seed outside Bihar might easily result in a gradual change of type which might prove quite unsuitable to the local soil conditions.

The work on the selection of Java indigo is proceeding as rapidly as circumstances permit. One of the early selections, Type 15, is being grown on the large scale on four estates. A number of others are being tested on a field scale and reserves of seed are being accumulated. Java indigo is practically self-sterile and almost all the seed is obtained by means of cross-fertilization following insect visits. These facts render selection work very difficult and the multiplication of promising types very slow as only one kind can be grown for seed each year in the Botanical Area. This difficulty has been met to some extent by facilities granted by the proprietors and manager of the Dholi estate. A small field has been lent in one of the villages of this estate for indigo seed purposes and at the present time two types can be multiplied each year.

II—BACTERIOLOGICAL.

The following are extracts from the Report of the Imperial Agricultural Bacteriologist (Mr. C. M. Hutchinson) for the year 1917-18 :—

The experimental factory referred to in the previous annual report came into use at the beginning of the current year (July, 1917), and although its working was seriously handicapped by the over-maturity of the plant, many valuable and interesting observations were made during the short manufacturing season remaining. It is impossible here to give any detailed account of the results obtained which will form the subject of a full report shortly to be issued as a memoir of the Department; the following general summary will give some idea of the conclusions arrived at and of the lines of further work made necessary by the character of the results obtained.

INOCULATION WITH SPECIFIC BACTERIAL CULTURES.

In the previous year's report of the Section it was shown that good reasons existed for believing that yield of indigo in the process of manufacture depended in the first place upon the completeness of bacterial hydrolysis of the indican content of the leaf : that this was determined by the presence or absence of sufficient numbers of specific bacteria, and that variations in yield between individual factories probably depended mainly upon the character of the bacterial flora of the steeping vat, this being again determined by that of the water-supply. This contention was fully supported and the whole theory confirmed by the experiments carried out in the Pusa factory in 1917.

The main line of experiment lay in the comparison of results obtained in artificially inoculated steeping vats and in uninoculated control vats, making use of pure cultures of various hydrolyzing bacteria isolated from the *khazana*, or *seet* water, or from the walls or timbers of the steeping vats of various indigo factories. Isolation of such bacteria was effected by the use of indican agar, on which those bacterial species capable of splitting off indoxyl from indican formed indigo blue colonies, and examination of a large number of samples from

various factories has led to the general conclusion that the known yield of a factory is closely and almost directly proportional to the content of such hydrolyzing bacteria in its water-supply.

The first problem to attack was the method of inoculating the water used for steeping in such a way as to ensure the presence of sufficient numbers of the specific bacteria. It may be said at once that this problem rapidly revealed itself as the basic one of the enquiry as a whole, and its solution is still under investigation. Nevertheless the results of the comparatively limited number of experiments made in the Pusa factory conclusively established the main principle that yield of indigo depended upon bacterial action, and *consequently* upon the presence of adequate numbers of bacteria of the proper kind. The very first experiment in which a comparison was made between the yields of two vats, one inoculated with a pure culture of a bacterium (laboratory mark In_{10}) and the other untreated, gave an increase of 15 per cent in the inoculated vat, notwithstanding the unsuitability of the over-mature plant available which should have been cut for manufacture at least a month earlier. Subsequent experiments were not invariably conclusive so far as yield of indigo was concerned, but owing to the careful analytical watch, both chemical and bacteriological, kept over every stage of the process, it was not only possible to account for discrepancies but to come to definite conclusions as to the underlying causes of negative results and the feasibility or otherwise of removing them. The general procedure adopted in carrying out each experiment involved chemical examination of the plant before and after steeping, of the liquor at various stages of fermentation and also after blowing and settling, and of the indigo precipitate or *mal*, and lastly of the waste or *seet* water. Thus a close watch was kept upon the fate of the original indican content of the leaf, and the effect of any method of treatment upon the percentage of this constituent which appeared at various stages either in its original form or as indoxyl or indigotin, was accurately ascertained. This naturally involved a very large number of analyses and as the quantitative estimation of indican, indoxyl, or indigotin is a tedious process and as each analysis was made, during the later period, both by the persulphate and isatin methods, it will be realized that the number of experiments was limited by the possible pace of output of the analytical data.

In the same way bacteriological analysis of the fermentation process was carried out for each stage of manufacture, but this analysis necessarily began with measurements of the rate of bacteria growth (by plating) in the mass cultures used for inoculation some hours before manufacture commenced, in order to discover the best conditions for securing successful inoculation. Plates were made from the mass culture after various periods of time from the original inoculation, from the *khazana* (reservoir) before and after the introduction into it of the mass culture, and at intervals up to the time of "watering" the vats, *i.e.*, running the water from the *khazana* into the steeping vats containing the cut plant. Fermentation continues after watering for varying periods of time up to some 12—15 hours, and plates were made at intervals to determine the rate of multiplication or otherwise of the specific bacteria artifically introduced with the water. The water used at Pusa was drawn directly from the river, and a large number of plates was made to ascertain the bacterial content of this water and the proportion of active hydrolyzers. This series of plates showed the very great variation in this respect which occurs in river water from day to day according to the incidence of the rainfall; immediately after rain large numbers of bacteria, derived no doubt from surface wash, appear in the river water; after 24 hours or less this extra

supply may have completely disappeared but in the meantime the character of the fermentation may be entirely changed owing to the presence of a relatively enormous number of bacteria in the steeping vat. It is a serious defect in the design of the Pusa factory that no provision exists for settling or filtration of the water so that in a large number of cases the extreme dirtiness of the water used introduced excessive numbers of bacteria of all sorts, the activities of which so far complicated the results as to make the latter of little more than negative value. Thus it will easily be realized that when endeavouring to compare an artificially inoculated vat with an uninoculated control, the existence in the water of both of a natural bacterial population already up to the limit of its capacity would inevitably reduce the artificially induced difference in bacterial content to a negligible quantity. A natural criticism immediately suggests itself; would it be practicable on a factory scale to remove any such excess of bacteria in order to make room for artificially introduced species? It may be said at once that the importance of this point was realized very early in the course of the experiments and our aim has beeu to find some practicable means of overcoming the difficulty.

In order to understand fully the points involved it must be realized that so far as indigo manufacture is concerned we may divide bacteria into three class:—

(1) active hydrolyzers,
(2) inert so far as indican is concerned, and
(3) active destroyers either of indican or indoxyl or both.

The artificial cultures isolated at Pusa have been selected for their positive and negative virtues, *i.e.*, they are active indoxyl producers and do not destroy any large quantity of indican without hydrolyzing it to indoxyl. On the other hand a large number of the bacteria found in the dirty river water are active indican consumers and may, even in twelve hours, destroy some 30—40 per cent of the indican present, thus reducing the yield of indigo to that extent. In addition to this positive action the competition which goes on between bacteria in any culture medium, whether natural or artificial, will seriously reduce the hydrolytic action of the beneficial bacteria if the activities of the latter are curtailed by the presence of superior numbers of the inimical species or even of otherwise inert kinds. It was found in 1917 that interference with bacterial control of the fermentation was due sometimes to excessive numbers of destructive bacteria and not infrequently to the presence in the untreated river water of a sufficiently large number of hydrolyzers to reduce the difference between the artificially produced water content of these desirable organisms and the natural one, and with it the yield of indigo, to insignificance. The frequent, but not constant, occurrence of this phenomenon provided an addition to the evidence upon which the theory underlying this work is based, namely, that the notable difference observed between the yields of individual factories can be correlated with the differences in the bacterial content of their water-supply.

Thus in the case of low yields we are confronted at the outset with a condition and not a theory, the presence of destructive and the absence of constructive bacteria, and the alteration of this condition is the object of our present research.

Two methods of attacking this problem appear to present themselves; the first and most obvious being the removal of all deleterious bacteria from the water-supply and the second, the use of artificial cultures of such quantity and vigour as to overwhelm the original population of undesirable bacteria.

It is a well-known fact that bacterial numbers in water can be greatly reduced by settling and still more so by precipitation;

mere storage in reservoirs also reduces them in quantity. Most factories use their *khazanas* or reservoirs as settling tanks, drawing off the water from the top by surface drainers; this is intended to remove suspended mud which would contaminate the indigo, but an extension of the method would undoubtedly serve to reduce the bacterial numbers, and in cases where bad fermentation sometimes followed by bad settling in the beating vat is a common experience of the factory, the use of *khazanas* of greater capacity and designed to effect more complete settling of the suspended matter in the water, would almost certainly lead to improved manufacture. Larger reservoirs would also reduce the proportion of water directly pumped without settling from the river or lake, which in many cases appears to be responsible for bad fermentation. It is a frequently observed fact that certain vats habitually give better fermentation than others in the same factory: various explanations have been given of this difference but the following one which does not seem to have been suggested appears to fit in with the conditions in many cases. In many factories the *khazana* is not large enough to supply water to all the vats in use at one time, so that a certain number of the latter are filled with water which has stood for several hours in the *khazana*, the remainder being watered by practically direct pumping from the outside source, whether river, lake, or tank. This would at once tend to create differences in the bacterial content of the steeping vats, which might very well be of a sufficiently high order to produce variations in the fermentation going on in the latter. Such variations would be reduced together with the number of bacteria by the use of *khazanas* of adequate capacity, allowing of settling the whole amount of water used each day. It is suggested that the not infrequent superiority of the yield of small factories and small vats may be traced to the very generally adequate size of their *khazanas*.

Apart from the bacteria present in the water it is to be remembered that the plant itself introduces an enormous number into the steeping vat. In the 1917 experiments it was frequently found that, whereas the uninoculated *khazana* water might contain very few hydrolyzers, yet the corresponding fermented liquor contained an abundance of this bacteria; this implied the introduction of the latter by the plant, and it may be asked how manufacture could be benefitted by purification of the *khazana* water, if the plant itself brings in so large a number of bacteria. There is reason to think, however, that this difficulty is not so serious a one as at first sight may appear, first because the bacteria generally associated with the plant do not seem to include as a rule any large number of deleterious organisms, and secondly because these bacteria, if they find the water already in possession of others, as would be the case with successfully inoculated *khazana* water, do not have time to exercise much influence upon the character of the fermentation. For this same reason beneficial plant bacteria must frequently be prevented from carrying out normal hydrolysis by the presence of unduly large numbers of detrimental organisms in the *khazana* water. The problem therefore is how far is it practicable to provide fairly clean water fer steeping, and how to produce a satisfactory artificial inoculation sufficiently vigorous to overcome the destructive action of detrimental bacteria already present.

A great deal of experimental work was done to determine the best way of making a "mass" culture, *i.e.*, a pure culture of the specific bacterium sufficient in quantity to stand distribution through the 6,000 to 10,000 gallons of water in the steeping vat without undergoing too high dilution. It was found possible to make a simple culture medium of ammonium sulphate, superphosphate, wood ash and sugar, and to activate fermentation by the use of about one gallon of this culture, after six hours' incubation, in each

1,000 gallons in the steeping vat. In many cases, however, growth of the artificial inculum appeared to be interfered with, probably owing to excessive competition with other bacteria and in some instances to failure to make the proper adjustments between the temperature of the mass culture and that of the steeping water, or even to the presence of unfavourable chemical conditions in the latter, and further work must be done to find out how to secure the most favourable conditions for the multiplication and activity of the artificially introduced bacteria. In other industries depending upon controlled bacterial fermentation the use of sterilized raw material is generally adopted; this would seem to imply that the absence of other bacteria is a condition of success for the employment of pure cultures, but it does not necessarily follow in the case of indigo. Here we have in the ordinary factory working frequent cases of losses of the order of 30—40 per cent due largely to imperfect hydrolysis, partly as a consequence of the absence of the proper bacteria and partly to the presence of abnormal numbers of destructive species. It appears probable from the past season's experience that by sedimentation and the introduction of sufficient amounts of vigorous cultures of the proper species it should be possible to alter the character of the fermentation in the steeping vat so as to secure more complete hydrolysis, but a considerable amount of work must be done before it is possible to elaborate a routine method suitable for use in a factory without immediate scientific control.

Hot Water Extraction.

In the report for the previous year (1916-17) reference was made to the use of hot water extraction as a means of eliminating undesirable bacteria; a further advantage of such a method would be to secure a higher percentage of extraction of the indican in the plant; the Indigo Research Chemist has shown that imperfect extraction in many cases leads to a loss of 30—40 per cent in ordinary factory working, and if hot water extraction could be successfully adapted to factory conditions, it should be possible to obtain a liquor not only comparatively free from bacteria (although of course not absolutely sterile) but containing a much higher percentage of the indican present in the plant from which it was derived.

With a view to obtaining information as to the possibilities of this method a hot water extraction vat was added to the factory equipment at the beginning of the current year; this consisted of a masonry vat sunk in the ground and having sloping ends and a draining platform. The water in the vat is heated with steam and the hot extract can be pumped to the steeping vats for cooling inoculation. Plant is carried into and out of the vat by a length of large mesh wire fencing net, thus obviating the trouble in handling hot material.

The experiments made with this method do not come within the scope of this year's report, but it may be said here that there appears good reason to suppose from results already obtained, that the method will allow not only of a high percentage of extraction, but of complete bacterial hydrolysis and the production of good quality indigo. It is, of course, quite possible that its use on a factory scale may prove uneconomical in view of the fuel consumption involved, but engineers whose opinion has been taken do not consider that tbis is likely to be the case.

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THE NEED FOR AN ECONOMIC SURVEY.

BY N. GANGULI, B. Sc.

WITH the growth of civilization changes are becoming more rapid than before owing to modern discoveries in science and other causes. The nations which fail to adapt themselves to these changing conditions must fail in life's race, for the power of adjustment *is* the true vital power and any deficiency in this dooms us to a perpetual obscurity and subordination.

In India, owing to various circumstances, this process of adjustment has been extremely slow. But we feel sure it is gaining in impetus, and the violent impact of the outside world, instead of affecting India adversely, will inevitably rouse her from her social stagnation and economic inertia. We are now beginning to get conscious of the fact that the old order of things has ceased to exist and that world-wide relations have been established, even with the obscurest villages of India.

No doubt, there are certain advantages in the simplicity of child-life; it has its beauty and its convenience. But, all the same, when we leave it behind, the complexities of adult life cannot be forced into the clothing of childhood. The conditions of the past age in India whatever may have been their beauty and advantages, were different from those of the present time; and therefore the type of organization which characterized that age cannot wholly endure now. In former days, the cultivator was quite satisfied if he could raise his own food and clothing. Very few of the uecessaries of life ever had to be bought by him,—the fields and the livestock providing him with his daily wants; and therefore he had little need of communication even with his neighbours, still less with the outside world. During the time when agriculture was a self-supporting industry, rather than a profit-making business, the fundamental character of the economic organization was its self-sufficiency and its social segregation. Each tribe, or class, produced goods for its own use only; there was no need of the medium of exchange and of any labour organization, that is to say, the economic problem of agriculture was almost absent.

But, to-day, we have come in touch with a wider world; and because that world is new, a fresh adjustment in our economic life is urgently required. Comparatively speaking, social systems and religious ideals are naturally slow to move; for any change in them means widespread dislocation, and therefore it is best that they should take time in any decision for change. But the economic pressure of the modern world is far too serious to allow slowness in our efforts towards the solution of the problems of agriculture which is the predominant factor in our economic life.

We know that some of our agricultural products form the basis of several industries, and therefore the world market is now at the door of our cultivator. It is not enough for him to consider merely what he is able to produce, he must raise crops for the world's market. The system of barter has passed away; he has to bear in mind the *prices* for which he can sell his crops and also the prices at which he can purchase his requirements from the world-market. Agriculture is no longer a self-supporting industry—it has to keep pace with the industrial evolution that characterises our time. It is this "Commercialization of agriculture" that calls for adjustment in relation to the socio-economic conditions of India.

The history of transition of agriculture to its modern aspect shows that while industrial evolution was making rapid progress, agricultural evolution was extremely slow in its growth. The result was that population migrated to the city and a decline of agriculture became conspicuous. Then came the discoveries of modern natural science, which

gave fresh impetus to agriculture, and thus revolutionized the art of food production. Side by side with the knowledge of increased production, "Commercilization of agriculture" began and out of this phase there emerged the modern economic problems of agriculture.

Modern agriculture is, therefore, not merely technological or scientific, it is a part of the commercial-industrial regime [illegible] of the century and the problem that is now facing politicians and economists is how best "to organize agriculture as part of a price-regulated society" The modern farmer must know how to produce crops which will sell for more than they have cost in production: he must understand the economic forces that regulate his profit, and, in case he finds himself to be a loser, he must know how to adjust himself to conditions which he cannot control. Let us, therefore, realise that all measures of reform towards the amelioration of the condition of the Indian peasantry depend for their success upon their *economic* soundness.

In India, we are in a difficult situation. The world's commerce, with all its intricate economic forces, is impending over us: our agricultural produce is sought for by every industrial country; a well-organized modern Government is at the helm of our destiny; yet we are in no sense modern, still less our farmers. The commercial and economic movements belong, no doubt, to the twentieth century, but producers of raw materials, round which these movements organize themselves, belong to the remote past. The whole machinery of the commercial and financial world are at the service of the powerful organizations in which the Indian cultivator has no place. He labours in his farm and produces jute, cotton, wheat and oil-seeds, but the prices of these farm products are fixed in London. Thus, the farmer is continually at a disadvantage in his transactions with the well informed commercial organizations, and he is easily exploited by captains of Industry.

Take the case of jute. The profit realised by everyone, from the country buyer up to the factory manager, is hugely disproportionate to the scanty profit realised by the grower. The jute forecasts, published by our Government, give an approximately fair estimate of the probable supply, and organized traders can conveniently speculate and fix their prices for jute.

The remedy for this state of things lies, not in appealing to the moral sense of the powerful, but in making our own position strong and secure. What we must do, if we are to resist economic exploitation, is to organize ourselves in a strong defensive line, and it is one of the functions of Agricultural economics to indicate the nature and extent of such an action.

Economic organization is the very heart of modern agriculture. All the factors of production, as well as of distribution, should be brought together in harmony under co-operative organizations. How this is to be done in our own case is a question which must necessarily come under the sphere of agricultural economics.

It is a truism to say that economic efficiency and education go hand in hand; to my mind, the problem of rural education should also be taken up by co-operative organization. It will have the double function of protecting the farmer's interest and of making him conscious of his position in the world's commerce. This consciousness will help to widen his views of life and he will realise within himself that his interests are intertwined with the whole world.

It is needless to say that the character of the social life depends upon the nature of its economic condition and most of the changes that lately have happened in our society has been brought about by our economic necessities. Therefore our economics cannot be dealt with apart from our social system.

Let me give an illustration. I came in touch with some villages where caste regulations prohibit selling vegetables. It had its meaning when different sections of the community lived upon occupations specially allotted to them, saviug them from the ferocity of uncontrolled competition. But with the change of conditions these regulations have become more of the character of a hindrance than a help. When it is clearly demonstrated that the use of bone-manure gives increased yield of paddy, farmers refuse to do so for fear of losing caste. In case of a bad harvest, the deities receive a liberal supply of sacrifice, and puja is offered for increasing the productivity of the land.

Therefore, as I hinted before, those who deplore the state of our poverty should remember that economic and social forces cannot be understood as isolated phenamena. Social development is certainly a co-ordinate factor in the progress of our rural civilization, and how it has retarded its growth and what solution there may be, it is the function of agricultural economics to determine.

Now and then, a great enthusiasm to minister to the farmer's troubles prevails in responsible quarters and some palliative measures are suggested to find solutions of the problems. Some immediate cause of miseries occupies our attention, such as failure of crops, agricultural distress, labour trouble in plantations, indebtedness of Indian peasantry and such other phenomena. But what is necessary is a careful consideration of the ecenomic issues involved in agriculture, for, whatever may be the nature of economic disturbances, they are never isolated phenomena. Therefore a comprehensive survey of the field of agricultural economics should be made before any serious work of reconstruction is undertaken. To do this, a clear conception of the *character* of agricultural economics has to be obtained.

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The character of agricultural economics varies with the nature of the goal which the nation aspires to achieve. For example, Germany's chief concern has not been merely to secure a large return to the individual farmer or to obtain the greatest return upon her productive expenditures, but her ambition has been directed towards obtaining security in a crisis of war. Speaking generally, her agricultural economics has been indentured to the service of a Military State. The following quotation from a German treatise on agricultural economics will explain itself :—

> Under normal circumstances the domestic agricultural production of a nation should certainly provide for the needs of the resident population as to necessary products of the soil, especially as to the indispensable foodstuffs. Otherwise the country falls into a position of greater or less dependence upon other states, which are in a position to produce more human subsistence than is needed within their own domains. This dependence is especially precarious in time of war and for such lands as, like the German Empire, are bounded on nearly all sides by other countries, and have only a very limited access to the open sea. In a war with Russia, France, England, or several of these countries together, the adeqnate maintenance of the home population might be seriously endangered. To be sure, the danger is somewhat lessened by a strong fleet, such as we hope to have in our possession in the course of a few years, but yet is by no means entirely removed. It remains, at any rate, an especially vital problem for German agriculture to strive to provide its domestic needs of indispensable means of subsistence, and particularly its breadstuffs. Out of regard for its own existence, even the government is compelled, so far as lies within its power, to assist agriculture in the solution of this problem.—(Translated and quoted in *Agricultural Economics* by Prof. Nourse.)

But the case of France is quite different. While the character of the German agricultural economics was being determined by mobilizing all resources for the purpose of "National strength and self-sufficiency" France devoted her attention to the *individual* prosperity of her farming population. It is with this object in view, that she

attempted to put into the hands of the cultivators of France the well devised scientific equipments necessary for intensive agriculture. I may quote a few lines from M. Jouzier's book, in which he points out that, after the cultivator obtains a thorough training in Science and its applications to farming,

"he is then able to practice the art of agriculture, which *involves simple transformations of material* by the process of cultivation, but not the industry of agriculture, which involves, at the same time and to a greater extent, the realization of an increase of wealth. And he needs moreover, *in order to* enable him to accomplish this double purpose, to appeal to social science, which teaches him to understand man so far as he is a social being, the needs and desires which govern him, the higher laws which he obeys *in the* social relationships which he forms with his fellow-men; he ought, lastly, to have recourse to rural economics in order to learn, as we have said before, to co-ordinate the action of all his industrial *resources, to the end of making* the *greatest profit* possible. But if, according to our point of view, rural economics remains the science of the internal organization of the agricultural enterprise, we shall not *commit the mistake of confining it within too* narrow limitations and excluding from its province all that concerns the relationships of the enterprise with the outside world . . . . . It is, so to speak, the agricultural science "of sciences, not because it claims a quality, but because it draws upon them all and sums them all up to speak the last word of technological science, profit."—(Translated and quoted in *Agricultural Economics* by Prof. Nourse.)

Thus, we see two distinct types of agricultural economics, one controlled by the military state, the other left to individual enterprise. Although the character of agricultural economics in India depends on the extraordinary circumstance of our close connection with a great manufacturing nation like Britain, yet the example of France stimulates our imagination. But unless we clearly understand what is really taking place in the economic aspect of Indian agriculture and collect data with scientific precession, we shall not be able to form any economic decision about our future programme.

Unfortunately, Indian economists have shown very little practical interest in collecting data on which the principles of agricultural economics can be based. They attempt to build theories upon such premises as are foreign. It is due to the fact that they are not, in the first place, familiar with the principles of scientific agriculture, and secondly their attention is directed chiefly to the problems of Industrial economics, when questions relating to *rural life become important*, our economists try to elaborate, in the absence of any reliable agricultural data, from general economic doctrines, certain economic ideas which can never be applied to a rural environment. Only recently some attempts have been made to collect data from rural areas with a view to ascertain the trend of the economic process prevalent in India. It can hardly be denied that many of the results of such enquiries have not only been inadequate but fragmentary and superficial. On the *other* hand, we gladly acknowledge our indebtedness to Dr. H. H. Mann, of Poona Agricultural College, for organizing an economic survey of a Deccan village. This is the first attempt in this direction, and we hope that similar studies will be undertaken by other agricultural colleges; for the effort to work out a better technique of farming cannot be wholly successful unless the necessary adjustment in economic conditions is brought about.

From the economic survey referred to above, it *is clear that two obstacles stand in the* way of introducing improved methods of agriculture, namely, the small average size of holdings and their scattered nature. As an illustration I may refer to a case, cited by Mr. Keatinge, of a particular landlord of Ratnagiri District, owning forty-eight acres of paddy land, who had it divided up into fifty-three separate plots. Dr. Mann's survey shows that such holdings are scarcely economic. We do not know exactly the situation in other parts of India, as no serious *investigation of the*

extent to which holdings are divided and scattered has yet been made. An Economic survey would place all such facts before us, and we could there discuss what should be done to mitigate the evil excessive division of land.

Schools and colleges for teaching agriculture are of very recent growth in India. No suitable curriculum, specially adapted to Indian students has yet been offered, and so far as the technical courses in agriculture are concerned the institutions follow a simple standard. Be that as it may, agricultural colleges in India should offer systematic *courses in agricultural economics*. The task of organizing an economic survey of our rural areas rests with the administrative officers of the agricultural colleges and the state Departments, and when this is done, the students will realise the public and social aspects of our agricultural problem. I know students who are well-trained in scientific agriculture but who lack interest in the economic aspect of the subject, simply because they have been taught agriculture only from the point of view of science dissociated from the agricultural life in its completeness.

I *have one more suggestion to make*, before I conclude. The status of our agriculture is not exclusively the concern of farmers; it affects a very large percentage of our population. To my mind it is a matter of the highest public interest, and as such it can demand careful considerations both from the people and the Government. Is it not then a fair suggestion to make that a chair for agricultural economics should be established in every Indian university? Surely the importance of agriculture in our economic life is great enough to justify such

"MYSORE ECONOMICS."—I.

PRICE OF AGRICULTURAL PRODUCTS.

By K. Subba Rao, B. A.

MYSORE is mainly an agricultural country. Agriculture is the largest staple industry of the State as in other parts of India. The bulk of the people are agriculturists and depend on land for their sustenance. Therefore if the Economic condition of Mysore is to be gradually and permanently improved, the conditions of the ryots, and of the agricultural labourers should be improved, and more produce should be obtained from the land. More agricultural produce whether of food grains or commercial crops would put more money into the pockets of the ryots and more funds in the coffers of the State.

The value of agricultural products is rising immensely throughout the world and in Mysore also. No reference to the Statement of Prices published in the weekly *Gazette* for the past forty years is needed to demonstrate the phenomenal rise in prices. It is not only every school boy of Macaulay but every child in every house can testify to this rise in prices and its present *abnormal enormity*. It is not only the rise in prices that the middle-classes and the poorer people have to grapple with, but it is also the unprecedented difficulty now felt *at times* of getting articles of food for any price, much less for the prices quoted. It is true that a number of extraordinary causes and a rare combination of adverse circumstances have contributed to the present crisis in the History of Mysore and of India, nay probably of the whole world. The great European war, the like of which the history of the world has never hitherto before witnessed, the difficulties of transport owing to the shortage of wagons and engines, the necessity of exporting food-stuffs to the great theatres of

war, are the principal factors. But the most important factor is the *general shortage in food crops* all through India (and throughout the world) during the past year, owing to want of timely and copious rains. The speculative tendencies of the wealthy merchants and any combinations to purposely keep from the market available supplies, if at all, play only a very subsidiary part in this general and world-wide rise in prices. During the past twelve months the rapid increase in prices of food-stuffs has beaten outright all previous records of famine prices. One great difference between famines so called and the present situation is that in former times, when there was scarcity of wheat or rice or fodder, there was hardly any rise in prices of clothing, kerosine oil or firewood or other necessaries of life. Note the price of almost every article in daily use, whether of indigenous or foreign make, has increased. Price of oil, ghee, curds, milk, of needle and thread, of paper, of chilies, of condiments, of clothing, of every imaginable article in use, has risen. Therefore even high prices for the ryots do not seem to be as effective as in days of old when the general purchasing power of the Rupee though low in regard to a few important articles of food, was relatively high in regard to other necessaries of life. For the large section of people who do not get anything from the land because they do not own any, the cost of life and the cost of rents of houses have risen beyond the highest limit of their power of management. Whether you call it in the phraseology of Economics, the diminishing purchasing power of the Rupee or by any other term, the plain truth is that Rs. 100 a month or Rs. 50 a month now do not enable a man or family to get all they could for half or one-third of that sum a few years ago. It seems that on the whole the cost of existence has increased by 100 or 150 per cent, if not more.

The history of rise in prices generally shows that even the exceptional conditions which caused the rise in prices disappear, the prices do not generally decrease to the lowest limit from which they rose.

As the war has interfered with the manufactures of the world and as it will take some time for the labour unrest in Europe to be pacified and the manufacture of machinery and implements for use on the pre-war scale, the cost of foreign manufactured goods and implements is not likely to go down very much in the near future.

It is problematical whether at any time even in the distant future the present prices will go down to the limit at which they prevailed in the pre-war period, in the normal prosperous seasons of that period.

What I wish to impress on the public is that the rise in prices is a world-wide problem and not confined to any locality. The distress owing to high prices and want of food-stuffs was begun to be felt in England and the Continent long before it was felt in India. If President Wilson and all the great allied powers of the West and the East are nobly striving for the peace of the entire habitable globe, Economists and administrators have to keep in view prominently the fact that for food production and supply, *the needs of the entire world,—of* the human race, has to be taken into account. If in any part of the world there is absolute want of any food grains, that want has to be supplied from other parts. Therefore if Mysore, Madras, Baroda, Hydrabad or the Northern Circars has any stock of grain, only as much as can suffice for its own people, the urgent requirements of other parts act as an almost irresistible force to offer higher prices and to transport the grain, adopting all devices which human ingenuity can conceive. Local control, Provincial control, and even imperial control, no doubt tend to regulate matters but all these are, I am afraid, not capable of literally confining the use of local articles to the locality itself.

The free and easy transport of food supply before the war has rendered the old methods of transport by carts over long distances too costly and obselete. The habit of preserving in each family food grains sufficient for a year or two, except in the case of very rich or wealthy, has been disappearing owing to the great need for cash for urgent purchases of other articles necessary for existence, owing to want of suitable methods to preserve without deterioration food grains, owing to the prevalence of plague, and other epidemics which render hundreds of houses annually miserable. The result is a very large percentage of the people are now accustomed mostly to get their supply monthly, if not at shorter intervals. I cite this merely to show that those who raise food grains now-a-days get rid of them as quickly as possible for cash and nay few families have both the money and the convenience for storing all grains and sundries for months together at a stretch. I have heard several stories of men getting enormously rich and very poor by speculations in several trades during the war period. It is inevitable. A sudden disruption of existing economic forces and a sudden call from all parts of the world for so many items of supply necessarily introduce chances and elements of success and failure hitherto unheard of. For the future the present crisis in prices is full of lessons. The most striking of these is that *it is only an adequate supply of food grains in all parts of the world that will be a satisfactory solution of the problem* in steadying prices. Just as every country is required to maintain a certain minimum number of police and armed force to ensure internal order and ward off external aggression, every country similarly has to produce a certain minimum quantity of food grains, so that the total output may meet the bare necessities of the human race. It may be that certain parts of the world can grow only certain kinds of crops and other kinds have to be transported from other parts. In such cases the exporting country has to grow enough for its own needs and also for transport abroad, or else the export being as important and as urgently called for as consumption within the place of production, the available stock for local consumption is depleted and the prices automatically become so exorbitant as to prevent local people from competing with any degree of success with outside demands and offers. To this must be added the inexorable trade requirements of foreign countries which require payments for exports from those countries to be made virtually in kind from the countries which import on a large scale articles of foreign manufacture. In the good old days when each little patch of country was self-contained, when exports of food grains on a large scale within India itself was not possible owing to absence of facilities and exports of food grains to foreign countries at a distance and to foreign continents were comparatively small or even unknown, the agricultural products of each place mostly remained in that area for consumption. If the seasons failed, people died by thousands on the road side. Because then transport of grain to a distance was not possible on the lines on which it obtains at present. It must be cheerfully conceded that if to-day in spite of the high prices no part of the country suffers by itself, it is due to the far greater facilities of transport. It was usual in the old days for one part of the country to have plenty while a distant part was sorely suffering from acute want. Now prosperity or adversity is spread evenly wholesale over the world. No part of the country can escape its due share of suffering, *irrespective of the quantity of food grains and commercial crops it might grow, for it has to share it with other parts.* The truth of this will be clear if I add that even now in large centres of trade food grains and necessaries of life are often obtainable on better terms for the purchaser, taking quality

and largeness of available quantity into consideration than at the place of production. Therefore the importance of increasing the quantity of food grains and industrial crops side by side till we reach the maximum is very great.

The old cry of "Back to the Land" was never more imperious than it is to-day. At first the custom of each village was to produce enough for the village when the concerns of the outside world did not interfere with its internal economy. Subsequently with the growth of trade and commerce, the interests became provincial and subsequently when the entire Indian Continent became one political entity, the agricultural welfare of one part of India was felt in other parts, till at last at the present day with the hope of peace of the world, the question of food supply also is slowly but surely becoming a world-wide-problem. *Our immediate duty therefore in Mysore seems to me to be in the direction of increasing the outturn of agricultural crops in the lands under cultivation wherever it is possible and to devise all practical means to bring under cultivation lands which are not at present under the plough*, but which it is possible to press into service if both capital and labour were available. And to this subject I shall refer in my next article.

The Institute of Agricultural Botany to be established at Cambridge, England, is to be devoted chiefly to the breeding and distributing of improved varieties of Agricultural crops. Modelled after the famous Swedish plant-breeding station at Svalof, its scientific specialists will work to produce pure cultures of the new varieties, and its commercial staff will co-operate in bringing these varieties into extensive cultivation.

CO-OPERATION IN BIHAR AND ORISSA, 1917-18.

By "Viator."

AN *interesting addition to the latest* Report of the Registrar of Co-operative Socities, Bihar and Orissa, is a map illustrating the progress of the co-operative movement in the Province. As was to be expected, the number of societies is largest in Bihar, the most thickly populated and advanced of the three Sub-Provinces. Even in Bihar, there are, however, still several sub-divisions which have less than five societies. Chota Nagpur is at present untouched by the movement, except in Ranchi and its immediate neighbourhood where mainly owing to the efforts of Catholic and Lutheran missionaries, societies are more numerous than anywhere else in Bihar and Orissa. It should be mentioned, in passing, that the supervision of the Luthern Mission Societies has now been taken over by the Anglican Bishop of Chota Nagpur and the Society for the Propagation of the Gospel, so that the fruits of the undeniably good work done by German missionaries in spreading co-operation will not be lost. In Orissa, societies are fairly numerous in the districts along the coast. Except in the west of the Sambalpur District, the remainder of the Sub-Province is coloured white in the map, which means that none of its sub-divisions has as many as five societies. This uneven distribution of societies throughout the Province bids fair to be rectified in the near future. Special propaganda work was undertaken during the year in the Tirhut and Patna Divisions and met with a considerable measure of success. The progress made in the Champaran District, where one gentleman, the Rev. J. Z. Hodge, has organized as many as forty societies is especially noteworthy.

In our last number, we reviewed the Report on the working of Co-operative Societies in Bengal in 1917-18. Certain features of the movement in 1917-18 in Bihar and Orissa strikingly resemble those in the adjacent Province. In both Provinces there was the same difficulty in regard to collections for much the same reasons. In Bengal, the percentage of collections to the total dues outstanding was 56. In Bihar and Orissa, it was even lower and only amounted to 52. For this very unsatisfactory state of affairs, it must be admitted that there was even greater excuse in Bihar and Orissa than in Bengal. The low prices of agricultural produce affected both Provinces alike but, in the case of Bihar and Orissa, sugar-cane, the one agricultural product the price of which did not fall, was damaged by floods in three districts and by an insect pest in one. Even more detrimental to the successful working of the societies were the outbreaks of disease which decimated the Province. The death rate from plague was the highest for many years, a virulent type of cholera ravaged the tracts in which co-operative societes are most numerous, whilst malaria took an exceptionally heavy toll in part of the Bhagalpur Division. In the circumstances, Mr. Mohi-ud-din Ahmad, the Officiating Registrar, is not without some justification for congratulating himself that collections were no worse.

Consolidation rather than a rapid expansion in the numbers and membership of societies or in their working capital was the order of the day in 1917-18 in Bihar and Orissa as in other Provinces. The number of societies, however, increased from 1,337 to 1,616 and of members from 56,200 to 60,778 whilst working capital rose from rather over 21½ lakhs of rupees to just under 30 lakhs. The Provincial Bank had a satisfactory year's working but its reserve fund only amounts to Rs. 11,000, which is out of all proportion to the magnitude of its transactions. As regards the working of Central Banks, the Registrar deals at some length with the important question of excluding overdue interest from profits for purposes of dividend distributed. It has at last been definitely decided that such interest shall be excluded. It was evidently high time that this decision was reached for the Registrar mentions a case in which one Bank had paid large dividends for several successive years on the strength of unrealized interest on a doubtful debt of Rs. 43,000. In order to be on the safe side, the Co-operative Department in Bihar and Orissa has gone beyond the recommendations of the Committee on Co-operation and requires Central Banks to include in the return of amounts overdue, sums for which extensions have been granted. We have no doubt about the wisdom of this course, for as the Registrar points out, there is a great temptation to grant extensions in order to submit a more favourable balance sheet. Both Central Banks and primary societies were rapidly succumbing to this temptation which has now been removed. In the interests of cautious finance, there is much to be said for excluding interest earned but not due from the profits of Central Banks. On the other hand, as Mr. Mohi-ud-din Ahmad points out, if there is ultimately a default in the payment of such interest when it falls due, it goes under the head "overdue" and is excluded in the following year.

It is interesting to note that, in Bihar and Orissa, the same difficulties are found as in Bengal in forming guarantee unions in the areas in which co-operation has made most progress, owing to the unwillingness of the societies to undertake the extra risks involved at a time when they have difficulties in meeting their existing liabilities. In the newer areas, the difficulties were not so great and the total number of unions in Bihar and Orissa increased from five to twenty-three.

Of individual societies, the Catholic Mission Society at Ranchi calls for special

mention. Although the membership of this society increased only from 11,016 to 11,687, its working capital rose from Rs. 1,41,399 to Rs. 4,37,644. This was due to the large deposits received from members of the society who were also members of a labour corps, 2,000 strong, which was sent to France. The pay of these men was received by the society which made them as well as their dependents a suitable allowance out of it and kept the balance in deposit to be used on their return for the reduction of debt, the redemption of mortgaged land or the purchase of new land or of cattle. It is an excellent scheme and the members of the society have every reason to bless Father Molhant, the founder of the society, with whom it originated.

The organization of co-operative societies amongst weavers is no easier a matter in Bihar and Orissa than it is elsewhere. The weaving societies of Ranchi and Gulzarbagh were saved from extinction by orders from the Munitions Board for dosuti cloth and durries. Whether the revival of prosperity brought about by these orders will last, now that the war is over and no more of them are forthcoming, is more than doubtful. The whole future of the handloom industry is very uncertain. The Industrial Commission emphasised the intimate connexion between co-operation and the improvement of cottage industries and, if the handloom industry is to be saved, it would seem that it can only be through the influence of co-operation. But, as Mr. Donovan pointed out in reporting on his efforts on behalf of the weavers in Bengal, the obstacles are very formidable and the Co-operative Department has a very uphill struggle in front of it. Experience in Bihar and Orissa shows that the supply of pure milk through the medium of co-operative societies is another problem which is almost insoluble. Of the milk societies in Bihar, the one at Gaya had to be closed, as its members reverted to their old drinking habits. The Bhagalpur Society worked satisfactorily but the total quantity of milk supplied during the year was only 340 maunds. The Registrar is convinced that the milk problem will only be solved by legislation, under which the cow-keepers would be evicted from municipal limits and compelled to settle in places where there would be facilities for grazing as well as for fodder growing and a "sporting chance" of sanitary conditions.

A development during the year which has great potentialities was the formation of three co-operative agricultural associations in Barh, Nawadah and Bihar.' Co-operative Societies in Bihar and Orissa have been helping to introduce sugar-cane into tracts in which it has hitherto been unknown, to spread the seed of improved varieties of wheat, jute and paddy—Pusa No. 12 wheat, Kakya Bombai jute and Indrasail paddy—and to distribute manures and improved implements. The work has been done by Central Banks but as it has increased, it has been found to interfere with their more legitimate functions. In the three centres mentioned above, it has now been taken over by an organization specifically formed for the purpose. It is intended that the associations shall arrange for the supply to their members of seed, manures, implements and other agricultural requisites, shall undertake the sale of the produce raised by their members and shall assist them generally in the cultivation of their land. Mr. Mohi-ud-din Ahmad lets his fancy play round a vision of what may be accomplished by co-operation in agriculture. He foresees the establishment of co-operative mills which will husk paddy, press oil, grind wheat and even, in time, make jute cloth. The articles turned out will be distinguished by a high standard of purity and so will command the best market. The bye-products such as oil-cakes and bran will remain in the locality, and will be available for manure and fodder The shareholders in the mills will be divided into two classes, preference shareholders

who will be Zamindars and well-to-do residents of the vicinity and ordinary shareholders who will be members of co-operative societies. The profits, after the statutory allocation to reserve has been provided for, will first pay a moderate dividend to shareholders and will then be distributed in proportion to the quantity of raw material supplied. We agree with Mr. Mohi-ud-din Ahmad that there is no reason why this should remain a dream. Co-operation can do for India much, if not all, that it has done for Denmark or Ireland. But three co-operative agricultural associations, after all, represent only a very modest beginning.

Other events in what was a very important year in the history of co-operation in Bihar and Orissa were the holding of a Provincial Conference, which recommended with the approval of the Director of Public Instruction that Central Bank's should be permitted to make experiments in starting primary schools, and the formation of a Co-operative Federation. The latter is modelled on the lines which have been successfully followed in the Central Provinces as was the case in the latter Provinces, the Registrar is the first Governor. It is not intended at present that the Federation should decide policy and lines of development though that is the ideal which is aimed at. It will, at the outset, provide a means by which the Registrar can ascertain the ideas and wishes of leading co-operators. It will also be able to levy a contribution from societies towards the cost of audit, in other words the principles of "no taxation without representation" will be carried into co-operation.

It is evident that the Co-operative Department in Bihar and Orissa is very much alive and that the new problems which constantly arise are being tackled with vigour and success. One regrettable feature of the movement is the attitude of the majority of the landowning classes towards it which, at the best, is apathetic and, at the worst, is hostile. They have yet to realise that such an attitude only covers them with discredit and that any increase in the prosperity of their tenants is bound to react favourably on their ow

GROWTH OF DEHYDRATION INDUSTRY.*

FOSTERED by large Government contracts, there is developing in this country a new industry that will be of material permanent benefit to our economic life. This industry is the dehydration, or drying, of vegetables. By subjecting fresh vegetables to the action of circulating currents of warm, dry air the moisture content is exhausted, with the result that the weight and bulk of the product is greatly reduced and the vegetable is made non-perishable and can be kept indefinitely. The cell structure and the flavour is not injured by the drying process; soaked in water for a few hours, the dehydrated product is restored to its original colour, bulk and food qualities, and when cooked it has the flavour and appearance of the fresh article.

A year or two ago the dehydration of vegetables in this country was practically unknown. There were one or two small plants engaged in drying berries and vegetables, but the bulk of their output was used in Alaska or other distant places, where food supplies must be light and durable. At the entrance of this country into the War, and when our soldiers began going abroad in large numbers, the War Department was confronted with the task of supplying enormous quantities of food to maintain the United States Army in France, at a time when the demands upon world shipping were the most pressing in the history of the world. To solve the food problems the various departments of the Government co-operated, and exhaustive tests were made of the different kinds of food available for export. The advisability of using dried vegetables was suggested, and a hearing on the subject was had before a sub-committee of the Senate Committee on

* With acknowledgments to the *Scientific American*.

Agriculture and Forestry, at which the food experts of the Department of Agriculture and the food commission appeared and testified as to the merits of the food. Representatives of commercial companies engaged in dehydrating vegetables were also heard, and the writer appeared before the Committee and told of his experiments conducted in California. Samples of dried vegetables were also exhibited, and hundreds of pounds of the food were distributed throughout Washington, to be tested for flavour and food values. The restaurants in the Capitol served various vegetables cooked from dehydrated stock supplied from the California plants, and scores of senators and Congressmen ate the food and were astonished at the similarity of the fresh. At the Reed Hospital, in Washington, 450 men were fed on the dried vegetables, and it was found that five pounds of dried stock supplied ample food for all. The President was even kind enough to try some dried tomatoes, which were made in soup, and many of the officials of Government tried the samples in their own homes.

CONTRACTS WITH GOVERNMENT.

As a result of these tests the War Department entered into contracts with several companies possessing the facilities for drying vegetables, and these contracts are being enlarged as the industry develops and can take care of new demands. On the Pacific Coast one organization alone now operates ten large commercial driers, employing several thousand people, and large acreages have been contracted in the vicinity of the drying plants for the growing of vegetables. Millions of pounds of dried potatoes, carrots, turnips and other varieties have already been shipped to our armies abroad, and a steady stream of the new form of food speeds across the country and the Atlantic to satisfy the appetites of our boys over there. The America Red Cross has also become a large purchaser of dried vegetables for use in its rescue work in the devastated regions and in this country many of the large charitable institutions are becoming interested in the produce for use in their work. The big shipping companies have found dried vegetables particularly adapted for use on ocean vessels, because of the small space required for storage, and the keeping qualities and superior taste over canned goods. Scores of the finest hotels from New York to San Francisco now serve vegetables from the dehydrated stock and they report that the food is superior to that made from anything but absolutely fresh produce. Many economies can be practised by these large institutions in using these dried vegetables, because all of the labour of preparing food is eliminated. There is nothing to discard, and no cleaning or washing of the vegetables is necessary, as all of this is done at the drying plant. Dietitians of Hospitals and food experts and chiefs all unite in recommending the food.

LARGE BULK IN WATER.

When it is considered that from 65 to 85 per cent of the entire bulk and weight of green or fresh vegetables is water, and that it is the moisture that causes decay and deterioration, it is apparent that, when the dried product is used, a wonderful saving can be effected in transportation, storage and handling. One pound of dried tomatoes or cabbage is equal to twenty pounds of the fresh or canned; one pound of spinach, when dried, is the equivalent of eighteen pounds of the fresh, and so on down to potatoes, which have a ratio of one to six. One carton of dehydrated tomatoes, weighing 2¼ lbs is equivalent to a case of the canned containing two dozen quart cans the whole weighing sixty pounds. Therefore, in shipping dried vegetables to our soldiers in France, the Government is able to furnish, in one shipload, as much actual food as could be carried in from fifteen to twenty shiploads of canned goods. If we went a bit further and included the weight and bulk

of the tin and wooden containers needed for the canned product, we should find a still greater saving for in every car of canned vegetables the containers alone weigh about 24,000 pounds. While the dried vegetables furnished by the government are put up in tins, they are large enough to hold about ten pounds each, and two tins thus make up a crate light enough to be handled by one man. The lightness of the dried product also permits vessels to be loaded to full cargo capacity, whereas in the case of heavy canned goods it is often true that the weight capacity of a boat is fully utilised without taking of all of the bulk.

CONVENIENCE OF THE FOOD.

The reason why so many of the hotels, hospitals and cafes are using dried vegetables is because of the convenience of the new food. The new cartoons or tins of each of the variety of vegetable can be spared in a small space and when desired for use the only work involved is to place a few handfuls in water to restore the moisture content. Where fresh produce is used, a small army of helpers is required to sort the green stock, discarding the wilted parts, tops or roots, and to wash the grift and dirt from the food. Even where the fresh vegetables are kept in refrigerated rooms, the loss through deterioration is excessive, and it is estimated that fully 50 per cent of green vegetables grown are lost before reaching the consumer.

Vegetables used for drying are grown in the immediate vicinity of the drying plants, and are allowed to reach full maturity before picking. Within an hour or so after coming from the field they are sorted and washed, after which they are carried, by endless belts, to various machines which peel, slice or otherwise prepare the vegetables for the drying trays. Wherever possible machines are used instead of hand labour, which insures absolute cleanliness and uniformity. The drying trays are taken to the drying rooms and arranged, one on top of another, with spaces on all sides, so that the warm dry air circulating throughout the room can come in contact with the food, slowly extracting the moisture without injuring the cell structure or chemical constituents of the product. The air is not allowed to get so hot that the food will be scorched or shrivelled, and by a system of distribution the air is kept in constant circulation at a uniform temperature throughout the room. When dried, the trays are taken to the packing room, and the food immediately placed in paper cartons, lined with wax paper or in large tin cans. Thus protected, the containers can be shipped to all parts of the world and the food will not be injured by excessive heat or cold.

At the drying plants nothing is permitted to go to waste, for all tops, peelings and waste portions from vegetables are fed to stock or hogs, and even the water used for washing the vegetable is saved and the mineral salts found therein are mixed with the greens fed to hogs.

GREAT OPPORTUNITIES IN INDUSTRY.

The expansion of the Industry offers tremendous opportunities to this country. With a large commercial plant or a community plant in each locality, a new market will be offered to vegetable growers.

Thousands of acres of waste lands in the outskirts of cities, towns and villages can be utilised for the growing of vegetables, and the spaces between fruit trees in orchards can be used for the same purpose. Surplus market stocks can be taken to a near by drying plant and saved, as is done in Europe. Germany has several thousand drying plants scattered throughout the country in which are dried all surplus vegetables grown and before the war she annually dried twice as many potatoes as were grown for all purposes in this country. Her dehydrated vegetables have doubtless been one of the reasons why she has been able to withstand the food blockade of the Allies. England, Italy and France are also large users of dried vegetables, and in many communities the law requires that all fresh vegetables left over in market at the end of the day shall be taken to drying to plant. The feasibility of the new industry has been fully demonstrated, and the only thing remaining to be done to cause it rapid expansion is to educate the people to use the new form of food.

TRADE IN WASTE PAPER.

BY THE EDITOR.

THERE is so much money in waste paper that it is a matter for surprize that there should be so few people in the waste paper trade. In England, the trade in waste paper is a well organized one. In India, on the contrary, waste paper collection is still largely unknown. What is collected is mainly sent to foreign countries. The want of paper factories has led to this exportation of waste paper to foreign countries. The Government of India Paper Expert stated the other day that waste paper had been of the utmost use in the manufacture of new material during the time the war lasted. Here is what he said :—

> "Let me put in a word for the manful way in which our local paper manufacturers have dealt with the position created for them by the war. You can scarcely imagine more difficult conditions than those they were faced with. Half their supply of raw material (European wood-pulp) cut off and chemicals at anything from five to ten times their previous cost and, in some items, not procurable at all, they have literally scarped the gutters and explored the dust-bins in search of material rubbish which five years ago they would not have thought good enough to throw into their boiler furnaces, and from this they have not only made a usable paper but have kept up their output at its old figure. Knowing something of what all this means I characterise it as a notable and splendid performance. The cynic will say it has paid them very well to do so, but I cannot admit that this in the least detracts from the merits of their effort. When they started to do it they could not know what prices were going to be and it is not they who have made prices: these have been made for them by a market which has been competing eagerly for every pound they could produce. They have done well and deserve well of the community, and owing to them our sundried bureacrats can still deliver their souls in three lines and have the honor to be your obedient servants on a full sized sheet of foolscap and enclose it in an envelope five sizes too large for it".

A recent writer on the *Recovery and Remanufacture of Waste Paper* says that waste paper has not been used even in England, until very recently in the manufacture of new paper. There has been considerable prejudice against its use as raw material. But this prejudice is giving way and paper manufacturers are taking to it more willingly. Before the War the American Manufacturer was the principal consumer of all British Waste paper. The Export Trade in it was a big one. Much waste paper was sent from Glasgow, London, Liverpool and the United States. Germany also exploited Britain in this particular material, as also Holland and Belgium. France also used large quantities of waste paper in the manufacture of newspaper and cheap printings, for the reason that she had to pay a high price for wood-pulp. The United States of America, however, imported the largest quantity of waste paper from Great Britain, more especially as the exportation of wood-pulp as such from Canada into the United States was prohibited by a special ordinance early in 1900. But in

Great Britain a great change came over her in this matter with the outbreak of the War in 1914. The prohibition of the export of all paper making materials soon became a necessity in view of the curtailed imports of wood-pulp. The British paper makers were thus made soon to realise the importance of waste paper as a raw material and in 1917 most of the British Mills were compelled to use all that they could get of it. The need for paper itself by the Government was found to be so great that the trade in waste paper itself soon came to be controlled. The trade in waste paper as a raw material is likely to go up in the years to come. The writer quoted above, who is a thoroughly reliable authority, says that " by the application of a systematic and scientific study of waste paper, this raw material will be used to much greater advantage than in the past."

This shows the real value of Waste paper. It is time that our people understood the utility of collecting " Waste Paper." Some idea of the extent to which waste paper has been used in England during War time may be had when it is stated that waste paper sold there during the height of the war at a price higher than that obtaining for new paper before the war. This was mainly due to the restrictions imposed on the importation of wood-pulp from the continent. A Royal Commission on paper was appointed and it controlled prices and supplies of paper. As certain kinds of waste paper (such as old account books, envelopes and letters) were found to be highly useful for munition purposes, this Commission soon evolved a system of collection of Waste paper in England, which has proved highly useful. A Chief organizer for all England was appointed and under him worked organizers for each country and these covered every mile under their charge. The organizers approached most of the local authorities and Corporations for the sale of Waste paper, the Corporation of London making a profit of £5,000 on their waste paper in 1917, and £9,000 in 1918. Some people are careful to collect their waste paper and sell it off to profit. These do not want much preaching. Some others are less careful. They have plenty to use and they do not worry about where waste goes into—into the dust-bin or the street ditch. These have to be weaned from their bad habit. The local authorities must be enabled to show a small reduction to rate-payers in the assessments, if they better dealt with the Waste. For instance, they may be induced to collect their waste and give it to the Municipal Cartman when he goes that side. The cartman should be provided with a bag to receive the same. This might be tied to the Municipal cart and taken to a central Depôt, where it may be collected and sorted and sold off to the proper parties. Then there is another class that deserves even closer attention. These are those that burn their Waste paper. These must be enabled to give their waste to people who may be trusted to destroy them in their presence in such a manner as to make it impossible for any one to know or use their contents. The Municipalities can in this way add to their income by helping in the collecting, sorting, grading and sale of waste paper. This is a matter worthy of close attention.

These are various uses to which Waste Paper can be put. Besides the manufacture of new paper from it, there are other uses to which it can and it has been put for ages past. For instance, what is known as papier-mache is made essentially from waste paper. This is really a light, durable substance made from Waste paper pulp or sheets of waste paper pasted together and variously treated with chemicals, heat and pressure. It is largely used for ornamental trays, boxes, light furniture, etc., in which it is varnished and decorated to resemble Lacquer work. It is also used for architectural decoration, in which it is made to imitate plaster moulding.. The manufacture of papier-mache, it may be added, was

learned by Europeans from Eastern nations, Persia, Japan and India have long been familiar with it. America has adopted papier-mache to use for railroad wheels, etc. Vegetable parchment waste has been used for the production of Oxalic Acid. Waxed papers are treated for the recovery of pulp and wax separately. The United States Bureau of Paper Standards (Technologic Paper No. 87) treats of the manner in which these kinds of paper should be dealt with. Waste paper of certain kinds imported into Japan are used in house construction there. White and coloured shavings are used largely for packing articles of a fragile nature. Waste paper in largest pieces is used for packing furniture and hardware.

Though some of the above uses for which waste paper has been put to cannot be avoided, the need for putting it to a more scientific use is coming to be recognised. In the years to come this use is likely to supersede all other uses to which it has been put in the past.

The part to be played by paper in reconstruction work in Northern France and Belgium is described in an article in the New York *Sun*. Ideas taken from the Germans and extension of present uses by American and British manufacturers are being combined. The work is going forward rapidly despite the shortage in wood pulp and its products. Waterproof pasteboard houses, easily handled and put together are probably the most important development. Such dwellings have oiled paper in place of glass windows. Screws made of wood-pulp are used in putting the houses together. Tables, chairs, and other pieces of furniture are being made of paper. Even kitchen utensils are so constructed. Ease of transportation, due to the enormous saving weight, as well as the ease of replacement, are the chief factors that are making paper a universal material of reconstruction days. Tin canisters are being replaced rapidly by paper containers. Paper buckets are more durable than galvanised iron or wood. Some other uses being made of paper are the following:—Garages, fire-proof by a special process; harness and saddlery; driving belts for machinery and roofing tiles. Paper cloths, counterpaints, bed-guilts, and blankets were made in Germany during the later period of the War to off-set the efficacious British blockade. Some of the ships which carry the paper made material to the stricken nations will be equipped with paper life-boats. This contribution comes from the Japanese who do not only thoroughly waterproof the Boats but are enabled by a process of cementing to build them strong and serviceable.

Since paper making in Mysore is being talked of as a practical proposition, it behoves us to save as much as possible of our waste paper, as its reconvertion into paper is one of the easiest and most economical ways of manufacturing paper.

It is now proposed to make use of fallen leaves to supply the lack of raw material for paper. On March 22nd, M. Edmond Perrier of the French Academy of Sciences presented before that body on account of the successful experiments along this line of research. The process is very simple, rapid and inexpensive; the leaves are first crushed, which reduces the blade to powder, which is carefully separated from the ribs and veins. It is the latter which form the raw material for paper pulp. They are subjected to a somewhat rapid leaching and are then wahed and bleached, after which the pulp is ready for use. The leaf powder is usable in various ways. According to a recent estimate by the Director of the School Orignon, France produces annually between thirty-five and forty million tons of dead leaves. It is calculated that only four million tons would be required to furnish the paper pulp required in an average year. The economic importance of the question is evident from the fact that in 1913 France paid $ 20,000,000 for the paper pulp imported from the Central Powers.

ECONOMICS IN THE WEST.

India and the East.

London, 20th March, 1919.—It is remarkable how small is the realization here of the industrial position which is being created in *India by force of circumstances and the* natural development of the energies of the population. At the Coal Commission, now sitting here in circumstances of momentous import for the future of British industry, we have heard much of the possibility of American and German competition with British coal in outside markets but very little indeed of the Indian factor which in days to come must be a highly important and even decisive one in some spheres in which home produced coal was formerly supreme. Much the same thing has happened at the Peace Conference. There has been interminable talk about establishing a uniform system of labour legislation and having a common understanding as to hours and wages, but scarcely a thought has been given to India and the East where the conditions of life and industry are so absolutely different as to make anything like a uniform world labour code an impossibility. It is true that in the semi-official report of the proceedings of the Committee of the Peace Conference which has had the matter in hand as a sort of after-thought we are told that "it is not expected that Orietnal countries like India and Japan can be brought to accept European conditions which their climate and social arrangements make inapplicable" and the pious belief is added that even these countries will make improvements *pari passu* with those made in Western countries "so that the conditions of international competition as between East and West would not be altered to the serious detriment of the latter;" but this comment only serves to show how very superficial has been the thought given to this immensely difficult problem of the reconciliation of Eastern practice with Western industrial ideas.

In the main it is no doubt true that as industry extends in the East a levelling up process is at work tending to reduce the disparity between Eastern and Western rates of pay and hours of labour. Moreover, there is a *greater disposition to accept the principles* upon which factory legislation is based. But making every allowance for the effect of these influences, there still remains a great gulf to bridge before there can be anything like equality of practice. That "the East is East and West is West" is in no respect truer than it is of the habit of thought in the matter of industry. The minute and complicated code of regulations which is accepted as a part of the ordinary routine without trouble in the Potteries District would not work for a single day in the Bengal factories. No sane Indian manufacturer would dream of accepting the trammels and heavy financial obligations of the arrangements to which British employers and employees accept as a part of the system. But the widest difference is in the matter of pay. Some English workmen earn in a day as much as Indian artisans receive in a month for their labour. Let me tell a story to illustrate the point. A *friend of mine the other day was doing* business with a member of a great iron manufacturing firm in the North. Said my friend: "I suppose some of your workmen earn as much as £5 a week?" "Five pound a week!" exclaimed the manufacturer, "do you know that only last week we paid out to six men £65?" It will take a long time I fancy to level up Indian rates to this level. And for my part I cannot see why Indians should make any particular effort to bring about parity of conditions. They are starting their industries and naturally cannot hope to succeed under conditions which govern long established enterprises in the West. They must proceed continuously and

sacrifice no advantage which they derive from their natural circumstances if they are to compete on even terms with the highly organized and intensely energetic industrial concerns of Europe and America. On the whole I am disposed to think that the International Labour Covenant will not have much effect in the East if, indeed, it proves anywhere anything more than a bundle of amiable aspirations.

DEVELOPMENT OF ELECTRIC WELDING.

Since the war ended we have been hearing a good deal about the wonders accomplished in various departments of applied science with the help of recent inventions. Take electric welding as an example. By means of this process something like miracles were worked or what at all events a few years ago would have been regarded as miracles. When the Germans damaged the engines of their ships in New York harbour so as to render them useless for the Allies, they thought that they had put them out of gear to such an extent as to prevent their employment for years. But the United States Naval construction department by means of welding were able to restore something like thirty ships to service without the casting of a single cylinder. The majority of steel tyres and rims used by the Army Transport Department during the war were electrically welded, one firm alone supplying approximately two million rims of this character. In the construction of locomotive boilers and tanks in the United States in 1918, it is estimated by a competent authority that the saving in metal alone owing to the adoption of electric welding amounted to £600,000. In the future we may expect that this method of construction will be more and more used in industry, more especially in the engineering and shipbuilding establishments where it has already proved its worth. It is satisfactory to know that we have achievements such as this development of electric welding to set against the record of official muddling revealed in the Chepstow shipyards.

DEVELOPMENT OF CIVIL AVIATION.

Arrangements are steadily proceeding for the development of civil aviation under the friendly ægis of the Government. In this connection General Seely made quite a remarkable Parliamentary statement at the end of last week. The minister for aviation sketched in a fascinating way the possibilities of the future and lifted the curtain on what is being officially done to meet the demands of the Peace Age. While he was cautious in estimating the rate of progress that the science will make he distinctly outlined a wonderful picture of enterprise. Aerodromes being established on the Cape to Cario route, a mail route to India *via* cairo vitually settled and measures for the linking up of the Empire by aviation—these are some of the features of an epoch-making speech. In regard to construction, General Seely made some interesting revelations. Apparently we have on the stocks either near completion or in an active stage of construction, new types of aeroplanes which are expected to do very remarkable things and not least in the matter of speed. On the whole it is believed that in aviation we are distinctly taking the lead and there is a very confident expectation that with the advantage which we derive from the possession of the control of the principal air routes of the world we shall be able to maintain it. The one obscurity in an otherwise clear and admirable exposition related to the bridging of the Atlantic. Concerning this the air minister was distinctly vague. Doubtless we shall wake up one morning to find that some venturesome spirit or spirits has flown across the ocean and brought New York into two days reach of London. Whether the flight will be from the West to the East or from the East to the West is an interesting matter for speculation. The chances are in the favour of American crossing as the wind and weather conditions favour this direction for the flight.

SOME INDUSTRIAL BY-PRODUCTS.

How immensely valuable are some of the by-products of industry has been demonstrated over and over again during the war. One of the most interesting revelations of this character was made recently at the Society of Arts when Mr. Edward de Segundo read a paper on the "Removal of the Residual Fibres from Cotton Seed" and their value for non-textile purposes. In the lecture room was installed one of the machines invented by Mr. Segundo for removing residual fibre from Indian cotton seed, and the lecturer explained lucidly the system by which the residual short fibre which escaped the gin or other saw linting machines was made available for various purposes. Thousands of tons, Mr. Segundo stated, had already been employed in the manufacture of explosives, paper, artificial silk and other cellulose derivatives. In illustration of the infinite variety and the valuable character of the uses to which the material may be put he exhibited samples of cotton seed flour, loaves of bread made with a mixture of cotton seed flour and wheat flour and paper, artificial silk and vulcanized fibre. As over 95 per cent of the 11,000,000 tons of cotton seed produced annually is of the woolly type there is clearly a wide range for this new industry. Mr. Segundo dealt in an interesting fashion with the possibilities of his invention as concerns the Indian trade. Pointing out that by defibrating and decorticating woolly cotton seed instead of crushing it whole a higher return per ton of seed was obtained in the cotton seed oil industry he stated that there were other advantages in denuding the seed of its woolly covering. The defibrated seed would command a premium above the price ruling for the undefibrated. The cost of freight from India to British markets would be lower, due to the closer bulking of the defibrated seed. The risk of seed heating on the voyage would be minimised and consequence the danger of fire. Mr. Segundo went on to say that considerable additional revenue per ton original weight of seed shipped from India to British markets would be derived by defibrating the seed in India before shipment. The products obtainable from the available quantity of cotton seed in an average crop in India, if wholly employed in the production of oil and cake, and if the residual fibres were turned to account, ought to be worth on the basis of pre-war values and after deduction of all manufacturing expenses, about £7 per ton of seed compared with £3 per ton, the estimated value of the seed previously under similar conditions. This represented a potential increase in revenue of about £6,000,000. It hardly needs to be added that if this invention of Mr. Segundo is in any respect equal to the character claimed for it it will revolutionise cotton planting especially in India which is peculiarly adopted for the employment of the new system.

The British margarine industry is one of the most important industrial by-products of the war. Before the outbreak of hostilities the home market was almost entirely dependent upon foreign; chiefly German, Dutch agencies for its supplies of this valuable domestic product. These alien firms thought their interests were best served by sending their supplies to Germany rather than to England with the result that our Government was driven to establishing factories under its own supervision and control for the manufacture of margarine. Possessing the control of supplies as the authorities did they were able to ensure a continuous supply of raw material for the establishments. Soon the public were being furnished with excellent margarine at reasonable cost, a most valuable advantage in view of the great scarcity of butter all over Europe. Now the supplies are larger than the domestic demand and exports are being made to central countries. There seems little reason to doubt that the margarine industry has come to stay. It will probably prove an important factor in imperial development and help to remove the reproach which has long rested upon British industry that it allowed staple raw material produced within the Empire to become the practical monopoly of foreigners.

ARNOLD WRIGHT.

INDUSTRIAL NOTES FROM THE UNITED STATES.

Over Six Million Automobiles in the United States.

Washington, D. C., U. S. A., April 12, 1919.—A canvass covering every state in the country brings the information that on January 1, 1919, a total of 6,225,192, automobiles and motor trucks were registered and in use in the United States—an expansion of 73 per cent in two years.

When one stops to calculate the investment represented in 6,000,000 motor vehicles he is amazed at its immensity. The average cost to the purchaser of the trucks and cars now on the roads of America was easily $1,000, so that there is here an investment of $6,225,192,000, and only a few years ago the horseless carriage was a curiosity, and there were even a considerable number of people who believed that it would never be a success!

It is a fair presumption that the mileage of these cars will average 5,000 a year, or over 30,000,000,000, miles every twelve month. It is also safe to say that the expenditures for tires, gasoline and repairs will average seven cents a mile or $2,100,000,000 yearly for maintenance and cost of operation. This waives all consideration of the very vital element of depreciation.

The field of the motor vehicle in the United States is constantly and rapidly broadening. An output of 1,500,000 cars—or perhaps 2,000,000—a year for several years to come is not an extravagant prediction—in fact is considered a conservative estimate. If the whole country had an automobile "density" equal to that of the state of Iowa there would be over 16,000,000 cars on the road to-day.

The automobile is here to stay. The luxury of yesterday becomes the necessity of to-day. It is permanently woven into our social and economical fabric. As the old car lags behind in condition, style and popularity, a new and better one must take its place—expense purely incidental!

Thus it is that Automobile stocks are fast growing in investment popularity. Only the preface of the motar car romance has been written.

WOOLWORTH, THE 5 AND 10 CENT WIZARD, DIES.

Frank W. Woolworth, who started a 5 and 10 cent store in the town of Utica, New York, forty years ago, on a borrowed capital of $50, and eventually became the multi-millionaire proprietor of a great chain of these stores in the United States, England and Canada, has died.

In addition to establishing a business with profits which exceed $8,000,000 yearly, Mr. Woolworth built the celebrated fifty-one story Woolworth building, on lower Broadway New York City, said to be the tallest building in the world.

Woolworth's life reads like a romance. He was born of very poor parents on a farm in the interior of New York state, on April 13, 1852. Until he was twenty-one years old he worked on his father's farm, obtaining a very meager education by attending school at nights, and later attended a business college. His first "job" was as an errend boy in a dry goods store, and he was gradually advanced untill he became a clerk and salesman, during which time he married while he was earning but $8.50 per week. He worked six years in the dry goods business in various stores before a successful bargain-counter sale gave him the idea of the possibilities of making substantial profits from nickel and dime purchases.

His idea was broached to his employers, who termed it "visionary and foolish," and he was advised to stick to the old-fashioned plan of conducting a store. Nevertheless, Woolworth was determined to test his plan, and his first venture was in the town of

Utica in the year 1879. He secured of friends $50 in cash and gave his personal note for the goods. In twelve months he had paid off his debt and saved some money. Closing out his store in Utica he located in a small city in Pennsylvania, and there he established not only a store, but the foundation of his fortune.

His rapid rise from a small "pigeon hole" store to the palatial Woolworth building on Broadway, New York—with more than eight hundred branch stores in the United States, sixty in Canada and England—forms one of the most fascinating and interesting business romances in the history of the world. The business was incorporated several years ago for $65,000,000.

In addition to being president of F. W. Woolworth & Co., he was a director in a number of banks and business enterprises. He maintained a splendid residence of Fifth Avenue, New York, noted for its rare paintings and works of art from every part of the world, also a country home at Glen Cove, Long Island, on the Atlantic Ocean.

United States Now a Creditor Nation.

With 30 per cent of the wealth of the entire world jingling in the capacious pockets of his striped trousers, Uncle Sam fingers over the I. O. U.'s for many millions of dollars which he has but recently received from other world-powers, and, like a good port gifted with shrewd business sense, waves his hand overseas and says: "I'll take it out in trade—come, show me what you have got to sell."

Changed from a debtor to a creditor nation during the nightmare of war, the United States realizes that if it ever wants to have the account squared it must take foreign goods in payment; if it wants to indulge the Yankee propensity for trading it must realize that there are two halves in foreign trade—give and take—selling something abroad, which is exporting, and buying return cargoes, which is importing.

American financial authorities, aided and abetted by the financial leaders of the country, are easing the way for development of both branches of foreign trade—exporting and importing.

Restrictions on foreign exchange transactions have been lifted by the Federal Reserve Board, and still others imposed by reason of war conditions are to be raised as soon as compatible with the best interests of the country. The united advice of the State Department, the Federal Reserve Board, and the War Trade Board and the cable and postal censors has raised restrictions affecting foreign exchange, foreign trade, and commercial and financial cables and communications. Great Britain, Canada and France are acting coincidentally with the United States in these matters.

U. S. Gasoline Production Makes Marvellous Record.

The story of the speeding up the production of gasoline is one of the most interesting and perhaps one of the most amazing of the entire war period. A special report on this phase of the response of America to the war call for materials by the United States Bureau of Mines is highly informing. It quotes the remark of a British admiral, who said, "We floated to victory on a wave of oil," and then proceeds to give the series of figures that confirm the view that the war was in great part brought to an end by the immense supply of gasoline furnished by this country.

In 1916, before the United States entered the war, according to the statement referred to, the production of gasoline was a little short of fifty million barrels annually. In 1917, when war activity was accelerated by the entry of the United States into the conflict, the production of gasoline had increased to nearly 68,000,000 barrels—an increase of more than 50,000 barrels a day. Many thought this was the peak of American gasoline production, but in 1918, when all war

blems had assumed greater proportions, output of gasoline in this country exceed- 86,000,000 barrels—an increase for the ır of more than 17,000,000 barrels. The ıly increase for this year over the record- ɜaking year of 1917 was about 47,000 rrels for each of the 365 days, or almost much more as the increase of the previous ar.

How this country sent over an ever-in- easing flood of gasoline to the allies and to iendly countries is seen in the export gures. In 1916 there were 8,743,102 bar- ıls of gasoline sent abroad. In 1917, this nount had reached 9,901,877 barrels, an ıcrease of about 4,000 barrels a day. In 918, these exports had reached a total of 3,312,508 barrels, an increase of nearly 0,000 barrels a day over the year 1917.

It is the opinion of the Bureau of Mines hat no single industry in this country of so mportant a nature ever made such a showing n a single year.

A NATION-WIDE ESTABISHMENT.

Uncle Sam is smiling happily these days, while he is running the biggest manufacturing establishment in the history of the world—a factory spread out over forty-eight states and taking orders from all over the world. The nations are sending here their raw materials and getting them transformed by American genius into food, clothing, tools, and the thousand and one requisites, aids and luxuries that advancing civilization has taught the people of the world an ambition to have and to use.

This situation mightily pleases Uncle Sam, for he appreciates that in this way the wealth of the world is being multiplied. There is a direct increase in value from the raw materials to the finished, manufactured product, and that represents the talent and technical skill of his workers. It represents their advancement in making something better out of what is taken from nature's store house.

But Uncle Sam is not content with merely running the world's factory. He is also sending to all lands the agricultural products from the best cultivated lands in the world, and is preparing to facilitate such supplying of the hungry of the world from his surplus crops. From the United States Bureau of Markets a number of agricultural trade commissioners are now proceeding overseas as permanent representatives to report on conditions and to study the marketing and distributing of American farm products of all kinds. Heretofore the United States has done little in the way of economic study of the demands and methods in foreign countries, and yet in 1913, a representative year, our agricultural exports amounted to $1,904,000,000—or 45 per cent of the total exports of this country.

MAKING THE FARMER'S CAR EARN ITS COST AND KEEP.

"She is running fine," remarks the farmer to his foreman, pointing with satisfaction to his automobile, in which he had just returned from a long trip.

"That is good," replied the farmer, "because there is a lot to do to-day."

"What is the programme for to-day?" inquires the farmer.

"Well, first we have to saw about fifty fence posts for that new pasture; then there are about a hundred bushels of corn to shell and some feed to grind, and if there is time we ought to pump a little more water into the tank. And we must not forget to make the butter that is to go to market in the morning."

The circular saw is stationed near the woodshed, and the lumber is piled up by its side. The farmer backs his automobile up a short distance from the saw. The foreman pushes an iron framework with a cross shaft of steel, having a fixed pulley at each end and a moveable pulley in the middle, under the rear axle of the automobile. Then he pushes down the cross-bar of the tilted frame. This lifts the

rear wheels off the ground, and when the cross bar reaches the ground the rear axle of the car slides down the inclined brace of the frame, until the tires of the rear wheels come to rest against the two eight-inch drive pulleys at the ends of the shaft. The drive belt of the circular saw is slung around the pulley in the middle of the shaft, the proper adjustment is made, and a few minutes later the buzz saw, driven by the car wheels, is cutting through the logs.

And so the corn was shelled, the water pumped, and the butter churned, all with the help of the automobile.

Soldering by Electricity.

Simple soldering jobs, such as splicing wires, fastening cable leads to terminal clips, or sweating metal plates together may be quickly and neatly done with the newly-invented electric soldering tongs.

The parts to be soldered are brought almost instantly to the correct heat, which is not at all possible with the ordinary soldering copper.

Two spring brass strips, 10 inches long $2\frac{1}{2}$ inches wide, and at least one-sixteenth of an inch thick, are used to carry the electric current to the carbon electrodes as well as to form the tong handles. Form two brass clips of such dimensions that they will hold, each, a piece of carbon 1 by 1 inch by $\frac{1}{2}$ inch thick. Rivet them to the end of the brass strips; a good job of rivetting must be done, and the clips must seat snugly against the strips so that a good electrical connection is assured. Saw a block of fibre $1\frac{1}{2}$ by 2 inches by $1\frac{1}{2}$ inches thick. Drill small holes in the free ends of the strips so that the latter may be screwed to the fibre block, parallel and insulated from each other. Provide electric wire connections to the brass strips.

These tongs must be operated from a low-voltage circuit, and for most shops the storage battery will best meet this requirement. For temperature regulation during soldering a variable resistance or rheostat should be used to decrease or increase the flow of current. To solder, it is only necessary to grasp the piece or pieces to be worked on between the carbon electrodes by using the device exactly like a pair of tongs. The instant an electric current is established between the carbons the latter should come to a red heat, and the soldering process is but the work of a few moments.

If it is desired, the brass strips may be wrapped with friction tape for convenience and safety in laying the tongs down. It is not necessary for protecting the hands if the rheostat is wound non-inductively.

Tinting Photographs without Special Coloring Matter.

Rural scenes, landscapes, sunsets, etc., appear to beautiful effect in a photograph which is tinted to an even pink. Yellow gives a most pleasing effect for some prints, as do also purple and red. The latter is especially appropriate for fireside interior scenes.

In order to obtain these tints, expose gaslight paper in the usual way, develop and then wash off the developer completely—be sure that it is washed completely from the print—then dry the prints in the dark room without fixing. Even an amateur photographer will understand the process well. When the prints are dry, expose them to the sun's rays until a tint is obtained considerably deeper than that which is wanted. Then proceed to fix the print in the usual way. Such prints are as permanent as those made in the ordinary way, as has been demonstrated.

Another method preferred by some is to use gaslight paper and print in the sun. Expose until the whole image is a dark purple. Immerse it in an ordinary fixing bath, which will at once tone and fix it. The color of prints made in this way is yellow, orange, pink, red or purple, according to how long the print was exposed to the sun. In both these methods good results can be obtained readily after some experimenting and trials.

Electrical Attachment for Oil Auto Lamps.

A patent has just been issued for an oil automobile lamp which can be converted into an electrical lamp without alteration by installing in it a handy attachment now perfected and on the market. The adapter consists of a socket for an 18 volt bulb mounted on the end of a curved wire that springs into the front flange of the lamp, holding the bulb suspended in the centre of the latter. The electric cord is strung through one of the vents in the base of the lamp and is not conspicuous.

Alfred T. Marks.

NOTES.

The following particulars relative to developments in Castor Oil Production in Spain are published in the *Board of Trade Journal* :—The preliminaries for the foundation of a new company to plant the "ticino" (*palma christi*) in Spain, and to produce castor oil, has just been completed. At Malaga, Velez Malaga, and Jerez de la Frontera, experiments have been made with good results in the cultivation of "palma christi." The blooms measured up to forty centimetres and the plant reached a height of from two to three metres after sixteen to eighteen months. This demonstrates, it is stated, that Andalucia is very suitable for its exploitation. The plant grows freely in the Spanish Zone of Morocco, but up to the present it has not been exported. Being a quick-growing plant a corresponding quick return can be expected from its plantation, and it would be of great profit to the native farmer if he could be induced to sow the plant. If sown in January the plant should produce two and sometimes three crops in good years. In winter the shoots have to be cut at the height of two hands from the ground, and they sprout again the following year. The crops of the second and third year are larger than those of the first year, and after three years the plants have to be renewed. The shoots and leaves are composed of long and strong fibres, and can be used for making paper. The pith of the plant, the lightest of all existing plants can be used for life saving materials. The trade in the seed and oil of "palma christi," the producing country of which is chiefly British India, is at the present time of considerable importance. The average importation of the oil into Europe from 1905 to 1916 was 5,513,000 litres per annum, valued at £113,646 and the average exportation of the seed from British India was 92,844,520 kilos, valued at £1,280,404. It is not possible to ascertain exactly the quantity of "palma christi" seed imported into Spain, because the Customs statistics include all oleoginous seeds. The imports of oleaginous seeds into Spain in 1914 were valued at 291,401,860 pesetas (£1,165,634). The kilo of "palma christi" oil which, before the war, was sold at pesets 1·25 (1s.), now costs pesetas 10 (8s.). In view of the large increase in consumption, it is unlikely that the price will return immediately to the 1913 figure.

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We take the following from the Report on the Administration of the Central Provinces and Berar for the year 1917-18 :—During the period under report an increased stringency was introduced in the grant of certificates of approval and in the scrutiny of the manner in which concessions are worked. A certain degree of laxity, which was perhaps permissible when the mining industry was in its infancy in these Provinces, is now out of place, and the attention of the Administration and its officers has been constantly directed towards obtaining the business-like exploitation of minerals. The two chief minerals in the Provinces are coal and manganese. The production of the former rose from 287,832 tons in 1916 to 371,905 tons in 1907. The figures for 1918 are not yet available. In 1917, 482,961 tons of manganese were produced. The former industry was stimulated by the difficulties of transport of Bengal coal and prices have latterly been ruling extremely high. The opening of the Ghugus field in the Chanda district in capable hands promises largely to increase the provincial output. In the manganese industry the higher rate of sea freights absorbed much of the extra price obtained, and though the larger and better organized mines did well, the smaller ones are reported to have profited little by the high prices. An important change of policy was decided on during 1918. The levy of royalty has hitherto been based on

the c.i.f. rate in the British market. As fluctuations in the rates of freight make it difficult to calculate the royalty, a Bombay f. o. b. rate, which happens to work fairly also for Calcutta, has been adopted. For minor miners, which are not governed by the Mining Rules, a system of consolidated acreage rates to cover all payments to Government has been adopted. Complicated accounts both on the part of concessionaires and Government are thereby avoided.

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The United States Consul at Teheran in a report to the Department of Commerce at Washington, says that a Chamber of Commerce, under the auspices and with the financial support of the Persian Government, has been organized in Teheran. The constitution, which has been approved by the cabinet, provides that the Chamber shall not consist of less than six nor more than eighteen members, one-half the number to be appointed by the Minister of Commerce and one-half elected by the merchants of the city. Provision is made for the organization of Sub-Chambers in the several cities of Persia, and steps have already been taken to that end. It will be the duty of the Chamber of Commerce to make investigations and report to the cabinet on subjects coming under the following headings: Questions relating to banks and banking, stock exchanges, commercial tribunals, transportation of merchandise, commercial expositions, trade extension, concessions, laws and regulations relating to business, customs tariff, prohibition and restriction of imports and exports, trade conditions, bureaus of commercial information, and commission merchants and brokers. The writer has interviewed the various members of the Chamber, and he has been informed in each instance that one of the principal reasons for its organization is the desire of Persians in all walks of life to strengthen and extend commercial relations with the United States. With this object in view, the Chamber desires to receive American trade publications and catalogues. Address "Chamber of Commerce, Teheran, Persia." A reading room will be maintained, where the same will be available for those interested.

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According to the Annual Report on the Forest Administration in Ajmer-Merwara for the year 1917-18, the following experiments were carried out during the year:—(1) *The Bitter Cassava.*—Cuttings from Travancore were received in the beginning of September 1917, and planted in Mohwabag nursery, where it is doing quite well so far. The *sweet cassava* was again tried at Pushkar, where it is doing excellently. Both these varieties will now be re-transplanted from cuttings from our present stock. (2) *Spineless opuntia.*—Is doing well at Pushkar and Sendra nurseries. They will be again transplanted now. (3) *Cassia auriculata.*—Twenty maunds of seeds of *cassia auriculata* were supplied to the Conservator of Forests, Eastern Circle, United Provinces, for Rs. 246, and a good deal of its seeds will be sown in Ajmer and Beawar forests. Its seeds have already been sown in Ajmer, Srinagar, Danta, Beawar and Sendra nurseries, where the plants are doing well, and they will be transplanted into forests at the beginning of the rains. (4) Lac from peepul trees were twice tried on Dhak trees but both times it was a failure. It is now intended to get its seeds from Dhak trees growing in a dry climate like Ajmer and then plant it on local trees.

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An Agricultural engineer points out that there will shortly be a need for many motor-ploughs, or light direct ploughs, capable of ploughing from six to seven inches deep, and which can be handled easily in small fields, and are, as far as possible, "fool proof." Owing to the weak monsoon, there are in India now thousands of acres absolutely bare and devoid of a blade of grass or a grain of corn, and consequently it is extremely difficult to keep bullocks alive. Prices had

already risen sky high before famine conditions were felt, and it is anticipated that before next ploughing season commences—which will be about the end of next month—about 50 per cent of the bullocks, which in ordinary circumstances would have been employed for ploughing, will have died. As a result, it is feared that there will be practically no bullocks left to haul the ploughs. The alternative is mechanical cultivation, and as there are several firms in England which have already placed on the market motor-ploughs which are suitable for conditions in the East, and, of course, in India, it is to be hoped that they will take the matter into their hands, and will not allow American and Japanese firms to establish themselves in the Eastern markets practically without competition.

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The British Government, have placed a fund of a million sterling at the disposal of the Research Department to enable it to encourage the industries and to undertake research. Much will depend upon the way in which this money is spent. The independence and initiative of the British manufacturer have contributed largely in the past to his success. After the war he will need all possible assistance in undertaking and developing research work as a means of enlarging his output and improving its quality. But if the help is to be effective, it must increase his independence and initiative. The Advisory Council for Scientific and Industrial Research have therefore recommended, after consultations with manufacturers and others, that the new fund should be expended on a co-operative basis in the form of liberal contribution by the department towards the income raised by voluntary associations of manufacturers established for the purpose of research. The fund for each industry will be expended by a committee or board appointed by the contributing firms in that industry, and the results obtained will be available for the benefit of the contributing firms.

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The sixth meeting of the Industries Section of the Board of Industries, was held on the 26th April, 1919, at Benares. The Board disposed of a reference from Government regarding an amendment to the Indian Explosives Rules, 1914. The desirability of starting a school for the training of ex-soliders in motor driving and in the working of oil and steam engines was discussed. The question of the appointment of a glass expert for these provinces was considered and a recommendation to fill the post now vacant owing to the departure of the later Expert, Mr. Elland, is going forward. The Board was pleased to note that a carpentry School has been started at Allahabad, from the 1st April, 1919.

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Information has been received from His Majesty's Government that the Allied and Associated Governments have decided that after midnight of April 28th all Black Lists of firms and persons which they have published or compiled shall be withdrawn and that all disabilities attaching to trade and communication with firms or persons on such lists shall cease to operate.

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The fifth meeting of the Education Section of the Board of Industries was held on 30th April, 1919, at Bareilly. Amongst other matters which came before the Board, the proposal to appoint a whole time principal for the Dyeing School, Cawnpore, was adopted. A scheme for the establishment of a leather working school at Meerut was also submitted and approved. Mr. M. A. Aziz's application for an extension of his scholarship of Rs. 75 a month granted to him in 1917, for the study of vegetable oils at the Indian Institute of Science, Bangalore, was disposed of and the Board decided to recommend it to Government.

GLEANINGS.

The following letter dated Darjeeling, the 18th April, 1919, has been sent by the Secretary to the Government of Bengal, Revenue Department, Forest Branch, to the Secretary of the Bengal Chamber of Commerce:—" I am directed to forward herewith, for the information of the Bengal Chamber of Commerce, a notice regarding a proposal for the execution of an agreement with Messrs. Andrew Yule and Company, Managing Agents, India Paper Pulp Company, Limited, granting them for the period of twenty-one years the right to extract bamboo, from the Kesalong Forest Reserve in the Chitaldrug Hill Tracts Division. The notice is published in the newspapers." The notice referred to, dated Darjeeling, April 18, is as follows:—" A proposal has been made to the Government of Bengal that they should enter into an agreement with Messrs. Andrew Yule and Company, Managing Agents, India Paper Pulp Company, Limited, granting them for the twenty-one years the right to extract bamboos for the manufacture of paper pulp from the Kesalong Forest Reserve in the Chittagong Hill Tracts Division at certain concession rates. Any objection to this proposal should be communicated to the Revenue Secretary to the Government of Bengal on or before the 3rd May, 1919, when they will be taken into consideration."

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A sample of Egyptian rice straw has been tested containing moisture, 11·8; ash, 17·7; cellulose, 50 per cent. The length of the ultimate fibers was 0·6—3·0 mm.; mostly 0·9—1·3 mm. On digestion for four hours at 140°C with 14 per cent of caustic soda the yield of dry pulp was 44 per cent; with 10 per cent of soda, 50 per cent; and with 8 per cent of soda, 52 per cent all expressed as dry pulp on air dry straw. These pulps all bleached easily to a pale cream colour, almost white. On digestion for 12 hours at 140°C with 20 per cent of lime, the straw yielded 56 per cent of yellow straw pulp suitable for boards and brown papers. The above experiments showed that a good bleaching pulp could be obtained with an unusually small consumption of soda, but this advantage is partly counterbalanced by losses in the recovery of soda from a material containing such a large proportion of silica.

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Further information with regard to the formation of a new paper pulp company in Algiers is given in the *Board of Trade Journal*. The company is called the "Société des Celluloses de l'Afrique du Nord," with a capital of three million francs, and it has been formed by the Société Nord Africain d'Études, 23bis, Boulevard Carnot. The object of the company is to manufacture paper pulp, paper, cardboard, etc., from esparto grass and other raw materials obtainable in the colony. We are not moving forward fast enough in this matter of Mill in Mysore.

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It is announced for general information that the following instructions for the issue of licenses for the export of mica have been issued to Collectors of Customs:—

(1) Exports of mica of all descriptions are permitted under license to the United Kingdom, as at present.

(2) Exports of all sizes and qualities of mica splittings and block, other than first and second qualities of clear and slightly stained ruby block of all sizes, are permitted under license direct to other British and to allied destinations.

TOPICS FROM ECONOMIC PERIODICALS.

AGRICULTURAL EDUCATION.

Materials for a Policy of Agricultural Education.

Writing in the *Agricultural Journal of India* for January 1919, Mr. H. M. Leake, M.A., F.L.S., (Economic Botanist to the Government and Principal, Agricultural College, Cawnpore) says :—

Myself when young did eagerly frequent
Doctor and Saint and heard great Argument.
About it and about ; but evermore
Came out by the same Door as in I went.

In perusing the voluminous literature, which has arisen on subjects educational, the quotation which heads this paper comes somewhat forcibly to the mind. I am not oblivious to the retort that this statement obviously raises, namely, why then add to that volume? I have failed to find an answer which satisfied myself, and am fain to admit that it is probably of the same tenor as that to the riddle of our childhood—the riddle I do not remember, but the answer was to the effect that the other donkey did so too. There are certain thoughts, however—perhaps, more suitably termed criticisms—which so constantly arise in such perusals that I am tempted to assume the *role of the other donkey and commence with a few general observations which will lead on to the more special subject of agricultural education.*

In all educational institutions, we have two factors—the pupil and the teacher ; the former, owing to the system of teaching in classes a multiple, the latter a single, intelligence. This condition too often offers the mental equivalent of a boat's crew. In training a crew for a race the coach has to think of the crew as a whole and attempt to raise the average physical fitness to the highest point on the day of the race. For this purpose, certain members will be over-trained or "stale" others under-trained. The system, of training, consisting as it does, or did in my own college days, of combined exercise in the boat, and individual exercise, known technically as swinging, affords a certain amount of latitude in adapting this system to the individual capacities of the oarsmen. Add to this the fact that the rowing age is an age of discretion, where the oarsman is capable of interpreting his own feelings and expressing them to the coach, and it becomes clear that the training for a race is a system interpreted by a coach, or teacher, who is aided and checked by the intelligence of the individual members of his crew. The similarity of the conditions of the teacher with his class, to those of the coach with his crew, is sufficiently near to mask the essential and great differences, and this similarity is *emphasized by the examination system which fixes a culminating point for the education.* For, just as the crew is judged by the result of the race, and as the coach attempts to have his crew in the pink of condition on the day the race is rowed, so the teacher attempts to have his class so mentally equipped on the day of the examination that it will show to the best advantage. To do this he, too, adopts a system and, to the extent that the class system, by which the pupils are distributed to him, and the examination system, by which he and his pupils are judged, become standardized, that system also becomes standardized, and impersonal,

The force of the comparison, however, lies not so much in the points of of similarity as in the differences, and this aspect will repay a brief consideration. The crew is judged by its combined effort which is the resultant of the individual efficiencies of the members of the crew. In the case of the examination, on the other hand, there is no combined effort—the individual efficiencies are interdependent, and the teacher will be judged differently according as major stress is laid on the average number of passes or on the standard attained by the most intelligent pupils. This difference may be expressed in another way. While the judge at the winning post of the boat race has no personal influence on the result of the race, and, through it, on the coach and the system of training, the judge *in the examination, in other words, the examiner,* according as he frames his questions and considers the answers to test the general standard of the class or to pick out the best pupils, will have a material influence on the teacher and his system of teaching. Of the former type, the examinations, as conducted in this country, are perhaps the most typical examples, while, of the latter, the scholarship examinations, as conducted at the older English Universities, afford a good illustration. The former appear to be the sounder, in that it will aim at the maintenance of an average standard of the combined teaching, within the understanding of all the students, about which individual exercises, adapted to the individual intelligences, can be built. The latter type of examination forces the standard of the combined teaching to the level of the highest intelligence—too far above the level of the weaker intellects for any system of individual exercise to be of value.

Again, I have stated the members of the crew have reached an age of descretion. They are in a position to judge by their feelings their physical fitness; they can convey those feelings to the coach who can modify the individual training accordingly. The pupil is in no such enviable position. He is not a judge of his own mental condition and the teacher is, thus, to this extent at a disadvantage, when compared with the coach, that he has to interpret his instruction in terms, not of his own intelligence, but of that of his pupils. This to my mind is a point rarely realized and realized with the utmost difficulty. Again and again I have listened to reasoned and logical arguments on conrses of instruction, the reason and logic of which, however, appeals to the adult mind, and I have found it impossible to avoid wondering, as I listened, whether the speaker had not assumed in his pupils, a mind as logical and as accustomed to reasoning as his own. The danger is, in fact, very real that, in evolving a system which is reasoned and logical, the teacher is evolving one which, by that very fact that it is reasoned and logical, will appeal to the adult and not the pupil mind. He has, in fact, failed in one of the main functions of a teacher, and he lacks the capacity of projecting himself into the position of the pupil.

There is yet a third difference in the comparison I have drawn. The coach's efforts are concentrated on the race and on turning out his crew on the day in a condition as near physical perfection as possible. It is no concern of his if, on the evening after the race, the stroke dines not wisely but too well, and is later arrested for obstructing the police; nor does he care if another member of the crew spends the rest of the day smoking till he becomes ill. The teacher is in a totally different position with his pupil. He does not, or should not, lose interest in his pupil on the day the examination result is published, though this is perhaps too frequently the case. A teacher who does this is not worthy of the post, and it is only necessary to consider one of the objects of education, and that is, to render the individual a usefnl citizen, to make this clear. Education has missed one of its main functions if it will not prevent the man who successfully passes the final examination from developing into a pickpocket.

By the above comparison, I have attempted to bring into prominence one aspect of the educational problem, and one which is frequently overlooked, namely the insignificance of the system compared with the individual. My statement that this aspect is overlooked may be called in question, and it is true that recognition is frequently accorded to the point. I cannot help thinking, on the other hand, that in this country, as in others, in the distribution of educational finance and in the grants lavished by Government for educational development, which are largely ear-marked as non-recurring and are devoted to the erection of new school buildings, too much attention is given to the numbers of schools teaching a standard curriculum, and too little to that improvement of the pay and prospects of the teachers, which alone will attract a better class to the profession, and thus remove the necessity for that rigid standardization which stultifies the individual initiative—so essential to the real education—of the teacher.

The above considerations are of general application; that is they apply to the educational problems of any country, but from this point, my argument proceeds along two lines, and deals more particularly with the problem as it appears in this country. The first of these deals with the type of education, as influenced by the conditions of the country, the second with the limitations imposed by the system of educational finance.

One of the functions of education has been already stated, namely, to render the individual a useful citizen. That may be highly materialistic aspect, but the modern world is materialistic and a country, if it is not to be left behind in the international race, must be materialistic. It is difficult, if not impossible, to find a brief definition, which will cover each and every function of education, and the above will, perhaps, serve as well as any for a starting point. Now it is obvious that the world would not be a satisfactory place to live in, if everyone were educated to the clerical profession. The clerk is a useful person, but once the number exceeds that necessary to carry on the essential clerical work, there must be a number of persons who are failing to fulfil that function. It may be that there is here a confusion between education and training, but I think not, though I admit the line of demarcation between the two is not readily drawn. Education then, considered from a national aspect, must be diverse, and, in its practical aspect, consists in placing before the youth of the country the essentials for the development of the mind in a form which will leave the individual in a condition in which he will render useful service as a citizen. In former times the guiding factor in the choice of a profession was mainly parentage, the son following the trade of the father, and this is still very largely the case, especially in more backward countries. But modern thought—the result of compulsory education—is increasingly in favour of equality of chance, irrespective of birth. Within wide limits, therefore, the diversity of education should be so disposed as to place within reach of each individual

a form of education suited to his probable future life. A more detailed consideration of the true meaning of this statement is desirable, since it is here, I think, that the fallacy contained in the modern claim for equality of chance, and in the various economic doctrines arising therefrom, is most readily exposed.

In the various professions by which the individual earns a livelihood, the labour expended is rewarded in very different measure in the apportionment of worldly goods, and, with the materialistic aspect of modern life, the professions tend to be judged by this standard and to be desirable in proportion to the measure of these goods received. Equality of chance in practice, therefore, implies a claim on the part of every individual to an education fitting him for the most lucrative profession. Now it is perfectly clear that the world would not be a fit place to live in if every individual were educated for the legal profession. Food and the thousand necessities of modern life have to be produced by human labour, and for that labour the education I have taken, as an example, is unsuited. Equality of chance, therefore, is not obtainable by the provision of an education, qualifying for the most lucrative fields of employment. The alternative, the equalising of the reward, while perhaps not theoretically unsound, is practically unattainable. It is only necessary to attempt to picture the economic condition of a country in which the farm labourer receives, say Rs. 1,000 per mensem *(a)* to understand how far we are from obtaining equality of chance by this means. The fact is such equality is an ideal, probably undesirable and, certainly, practically unobtainable. Labour of the brain always has been, and will continue to be, more liberally rewarded than labour of the hands, though change may occur in the degree of divergence. Equality of chance is, thus, a fallacy; nevertheless the idea has an underlying basis of truth. That truth is, I think, this: while, for the majority, it is desirable that an education shall be provided which will fit them to fill the station they are most likely to occupy in life, namely, that into which they are born, modern thought demands and rightly demands, that the individual should not be bound by the accident of birth. Far from this meaning that each individual has a claim to the highest form of education, it implies that a ladder should exist by which individual has a claim to the highest form of education, it implies that a ladder should exist by which individuals in any particular station can ascend, if so fitted, to a higher one. Advancement is, thus, not an inherent right, but the reward of merit. One error running through educational discussions and educational schemes is the misplacement of these two objects of education—the conversion of the ladder provided for the gifted to a broad staircase for the mediocre. The effect of this error is to be seen in most countries, but in none, perhaps more so than in this. The average individual is led to expect, regardless of economic laws, on education fitting him for a station into which he was not born and, in after life, a remunerative field in that station. The inevitable result is disillusion: the source of half the social unrest in this and most advancing countries.

I think we have now reached a stage in the argument which will enable us to provide a truer view of educational aim. It is that the main, and major, educational object should be to provide an education which will leave the individual a useful citizen in the sphere in which he was born. The educational ideal, contained in the above, is to inculcate in each individual that habit which is briefly and succintly given in the catechismal saying: "to learn and labour truly to get my own living and to do my duty in that stage of life into which it shall please God to call me. *(a)* It may be argued that that attitude is incompatible with ambition, the desire to ascend, but I think not. That desire may exist alongside the ready acceptance of the fact of failure. But while I insist that this *ideal should form the main object of educational* policy. I am equally certain that the object will only be completed by the provision of what has been termed a ladder, but a ladder so hedged about that only those suitably-equipped may ascend.

If the arguments adduced are sound, it follows that in any country the type of education most commonly found, should be adapted to fit individuals for the occupation most commonly practised, and it

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(a) The same condition will be reached by assuming the High Court Judge to be paid Rs. 7 per mensem, the essential fact being the relation between cost of production and purchasing capacity—that is, relative and not absolute values.

(a) "To do your work honestly, to die when your time coms and go hence with as clean a breast as may be—may these be all yours and ours by God's will. Let us be content with our status, telling the truth as far as may be, filling not a very lofty, but a manly and honourable part."

In turning over the pages of Thackeray's "Essays and Reviews" during an idle half hour, I have, since this article went to the Press, chanced to light on the passage above quoted. It is one which would be hard to equal as a definition of the educational ideal.

is only necessary to glance at the figures to appreciate how far education in this country is from the ideal I have outlined.

In the United Provinces "two-thirds of the population are supported by Agriculture, and there is no *single occupation which supports one-tenth of this* number of the people." In actual figures these are *divisible into the following main classes*:—

Zemindars, non-cultivating	...	500,000
,, cultivating	...	3,000,000
Tenants with some occupancy rights.		10,500,000
,, ,, no occupancy rights	...	10,250,000
Sub-Tenants	...	2,000,000
Labourers	...	4,500,000
Total	...	30,750,000

While the latter two roughly constitute a class whose standard of living is such that the children have to begin to take a share in the family labours at a very early age, and for whom, therefore, the simplest primary education is all that can be provided, a very large proportion of the remainder occupy a position, such that the children are not compelled to earn a livelihood till the age of 17 or even later, and for whom it is desirable, both on individual and communistic grounds to provide an education, fulfilling the conditions I have laid down. I have said on individual and communistic grounds—individual, because the world's progressing is affecting agriculture equally with other occupations, and that man will succeed best who most clearly appreciates this progress and most quickly profits by new markets opened to him; communistic, because sound development of a community is only obtained by equality in the rate of educational progress of its several component parts, the unsoundest form of development being that where a small minority progresses, while the bulk of the population stagnates.

There is thus a large community, probably larger than any other single community of the Province, in a position to benefit by a suitable form of Agricultural education. This state may be compared with the educational facilities provided, and in doing so, care must be taken to distinguish between teaching agriculture, and education fitting the student to return to the land. The point need hardly be laboured: the literary nature of the mass of the secondary education, unfitting the student for practical work of any nature; the location of the schools in urban surroundings, accustoming the student to a social life he cannot obtain at his home, and replacing the healthy outdoor life of the individual by the artificial sports of the playground —of which, though a true admirer, I recognise the limitations which include a dependence on companions for the supply of his physical recreations—are too well-known to require further development. It is true attempts have been made to introduce agriculture into the school curriculum. These, however, come to grief from failure to distinguish between teaching agriculture and supplying an education suiting the pupil to return to the land. It is not to realise that the student truly from an agricultural stock knows a great deal about practical agriculture, usually a good deal more than the master provided under such conditions to teach it, and such attempts as have been made hitherto to rectify the educational deficiencies indicated, have failed from this cause.

On the first line of my argument, therefore, we have arrived at the conclusion that the present educational system totally fails to satisfy the needs of *the largest single element, if not the major portion*, of the community. It is true that there is an Agricultural College, but that is a coping stone without the underlying structure. Moreover, the position of a College will be more clearly understood when the second line of argument, has been developed.

Educational effort, like every form of endeavour, is limited by financial considerations. The necessary funds are obtained in a variety of ways. In many cases, as in the older Universities and Public Schools of England, the funds arise from endowments, a system well illustrated by the munificent gifts which have been made for education in the United States. In others, of which the primary educational institutions of England and a large proportion of those of this country are examples, the funds are provided by Government. In the former case the trustees are the sole arbiters in any questions as to the disposal of the available funds, and the primary consideration is the degree to which the founders' terms are complied with. In these cases, there is no question of a financial return, the trust is complete with the fulfilment of the conditions imposed. Where, however, the funds are provided by Government the position is different. Government is merely in the position of trustee for the country, and it is its duty to see that the country receives the fullest measure of return for the expenditure involved. It is no part of my argument to justify the expenditure of public funds on education, that is generally admitted; my concern is with the measure of the return received, with relative, rather than with absolute, values. There can be little doubt of the relative value of the two classes of education; that which, on the average, fits a man for full development in that station in which he lives and has his being, and that which compels him to seek among fresh fields and pastures new to him, his means of livelihood. The former is a process of gradual evolution of the individual

which allows for development owing to the gradual interaction between the individual and his surroundings; the latter partakes of the nature of thrusting hot glass into cold water, a process ending usually in the destruction of the glass vessel.

The true error in the educational system of this country, as I conceive it, lies in the fact that it has hitherto developed along lines which render it unsuited for the largest single element, if not for the major portion, of the population. This is no complaint that the educational facilities are excessive, but it is a very definite statement that the fullest measure is not being obtained for the funds expended. This is not merely based on negative considerations implying merely a waste of funds, such would be the case, if the schools and colleges were filled by the sons of the clerical learned professions; it implies more than this, the expenditure of funds on directions actively harmful; for, by failing to provide an education fitting the son of the land-holder to remain on the land, the system drives such persons into a line of life for which they are unfitted, and in entering which they become as the hot glass to cold water. What is needed, and urgently needed, is the development of a form of education which will leave the average country youth fitted for life in the surroundings in which he is born; there is ample scope in such surroundings for the educated mind to find full and useful employment and to fulfil the *role* of a useful citizen which we have laid down to be one of the main functions of education.

It is open to argument that I am here labouring to prove a point, the importance of which is already sufficiently recognised. In part that is true; the recent conferences on agricultural education, the first held two years ago at Pusa, and the second last year at Simla, indicate this. The "memorandum showing what has been or is being done to impart agricultural education to the sons of cultivators," published in connection with the report of the last conference, however, shows that a relatively small amount of effort has been devoted to this aspect of education. Nor is my main object to supply this proof. I am tempted to think the difficulty has lain not so much in the recognition of the fact as in the recognition of what constitutes a suitable form of education. The arguments, I have hitherto adduced may incidentally prove this point, but that proof is only incidental. Their main advantage lies in the fact that they provide a point of view which will, I think, help to point a way to a solution of some at least of the practical difficulties involved.

I have tried to show that, at least where the funds are provided from public sources, there is a very definite financial limitation to the method of disposal. This will become clearer on considering a concrete case. The Cawnpore Agricultural College has a four-year diploma course limited to twenty-five students per year, or a total of 190 students in residence. The college budget is Rs. 43,600, but this is clearly an under-charge, as it excludes all charges on the botanical and chemical sides, which are budgetted jointly with research, and it is merely the recurring charge without allowance for interest on capital charges or depreciation on building accounts. It is probable a figure of three-fourths-of-a-lakh is not an over-estimate—that is, a cost of Rs. 750 per annum per student. The question is, under what circumstances is the expenditure of this sum of public money justified? It is always difficult to argue with any degree of conviction as to the justification of expenditure where the return is as in this case, indirect. The subject is, therefore, best approached from a different aspect, and there are two such. The first is to discover the circumstances under which that return will be a maximum; and the second to consider the class of applicant now seeking admission.

The justification of the Agricultural Department must be found, in like manner, in the improvement of the economic conditions of the country, and, no doubt, the expenditure of the college is justified to some extent by the necessity of training members for that Department. That, however, is a minor matter, two only, out of the thirty-five students annually admitted, being admitted to the Service. Were that the only object of the college, it would appear possible to find a more economical method of recruitment. The truth is that the ultimate justification must be found in the future career of the 23 remaining students.

Now, considered in a relative aspect, it cannot be doubted that a single zemindar, possessor of several villages, who takes a personal interest in his estate and who is progressive, by reason of a liberal education such as the college is now in a position to give, is potentially a far greater asset to the country than the small zemindar or tenant cultivating a few *bighas*. In the former case the gain is not limited to the actual money value of the better crops produced, and of the extra gain due to better business methods, great though this may be. His property forms a practical demonstration which must have some influence on the surrounding countryside, and he himself becomes an unpaid propagandist of new methods. The latter, on the countrary, can do little more than grow better and more valuable crops, and he possesses little of that which we may briefly sum up as influence. The college will be filling its function to the full, therefore, only when

the main source of recruitment is the zemindar class, a class relatively small, perhaps, but numerically large and potentially powerful. It can hardly be doubted that a college with students so recruited would be in a position to do more to improve agriculture and the economic conditions of the countryside, on which that improvement so largely depends, than one with students recruited from any other source. It is the condition in which the college will most fully justify its existence.

That, at least, is the aim I have set before myself, since I have been in charge of the College at Cawnpore. It is, for many reasons, an aim not immediately reliable. The larger landholders are mostly non-resident and have more immediate interest. The smaller ones are shy and frequently insufficiently educated. For the present it is sufficient if a few only of this class come, and it is a hopeful sign that this is the case.

The majority of applicants at the present time are, nevertheless, men merely seeking Government appointments intermixed with true agriculturists, petty zemindars or tenants. Frequently the application is accompanied by an appeal for a stipend. With the former I have no concern, they are not the type of student for whom there is any opening. The latter, however, form the class to which the Department looks for its recruits and the admission of a few is justified on this ground. The claim for a stipend is a different matter, and as it is here that the financial aspect receives its clearest demonstration, a short digression will not be amiss.

To any one who has had to deal with the selection of students for admission to a college, the frequency with whick poverty, as a ground for admission accompanied by financial assistance, is advanced, will be well-known. The fallacy of such a claim has, as far I am aware, never been shown up ; it is certainly not generally recognised. What applies for one, applies for all. Were poverty to constitute in one case a claim to admission to a college with a stipend, every youth of suitable age would be justified in demanding this concession, and the collegiate education would become the standard, the State is called upon to provide. The cost, placed at Rs. 750 per annum in the case of the college, to the State is clearly prohibitive, and those persons who advance such a claim forget that the money to provide the education and stipends ultimately comes from their own pockets. The fact is that stipends are only justified in cases where poverty appears as a check to an ability, to the possessor of which a college course will open a useful and profitable career.

I have now attempted to define, by reference to the Cawnpore College, the legitimate function of such an institution. That function is, to a certain extent, based on local conditions, and is not therefore, necessarily identical with that of other colleges. The same financial consideration, however, underlies all, and the college aspect can never do more than touch on the fringe of the problem, reaching as it does only the numerically smallest class of persons connected with the land. If the true function is performed, however, the college will be the means of providing, in the departmental district officers and in the progressive zemindars two agencies of effective agricultural development. The speed of introduction of improved methods is, however, a reciprocal process dependent not only on the skill and energy of the instructor, but on the receptivity of the instructed. While, therefore, the is providing for the former, the later college is in no way provided for. The form of education provided is too expensive for the mass, it is moreover collegiate.*(a)* What is here required is a cheap form of secondary education, complete in itself and complete within the limits provided by the age at which the average boy leaves school. In the United Provinces, the sole attempt hitherto to provide an education of this type is in the vernacular two-year course of the college. The institution of this course and its location at the college is admittedly a temporary arrangement and the course suffers from many disadvantages. In the first place, the age of admission is too high for a true secondary school, being the same as for the four-year diploma, or collegiate course. Secondly, in addition to supplying a course of instruction suited for the class which we are now considering, it attempts to meet the needs of the members of that class which I have shown the college should attract, but those members who possess insufficient knowledge of English to take that course, two aims which are incompatible. While, therefore, the course has not been without its uses, it fails in several directions to meet the needs of the situations. In other Provinces greatest progress in attempts to solve the problem has, perhaps, been made in the Bombay Presidency where several vernacular agricultural schools are in existence. The cost of each pupil is stated to be Rs. 180 per annum, grounds which alone would place it beyond consideration for universal adoption.*(b)* The main problem, the provision of schools supplying an education fitted to the needs

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(a) Or should be. Owing to the weakness of the secondary education, the teaching has to make up the deficiency and is largely secondary in character.

(b) Aboarding secondary school of the present type cosfs approximately Rs. 60 per annum for each pupil.

of the mass of the agricultural population and at a cost which makes possible their establishment in numbers sufficient for the accommodation of the available pupils, still awaits solution.

The primary object of such schools will be to raise the receptivity of the younger generation of agriculturists and the method of attainment must be *through education under conditions which retain the association with the land. This is a very different* proposition to the provision of vocational schools of which the main function is to impart technical skill. In the latter, technical instruction is the primary consideration, and theory is only taught in so far as it bears on the particular trade. In the former it is true, subjects being on the vacation may, and do, from part of the course, but the centre of gravity of the instruction is shifted. These subjects are taught for their internal value as a means of education, and the practical application is left to be drawn by a process of natural imbibition in the daily life. It is here, as I think, that the efforts, which have been made to introduce agriculture into the existing schools, have failed.

Let us consider for a moment how an agricultural echool of this type would be organized. The courses of instruction are to be educational and the students are to be introduced to an appreciation of a standard of country life, something superior to the ordinary village life that, I have known, by a process of familiarity. Although, therefore, not directly a part of the education, the conditions and their arrangement will form as, if not a more important section of the school organization than the purely educational section, in that they will form an essential of all such institutions, while modification to suit the different grades will be made in the educational courses.

I will try and bring out the main features of such an organization by a description of such a school as I conceive it. It is to offer a practical demonstration of village life under improved conditions, under which the student will live and have his being with a degree of intimacy that will render those conditions a normal part of his existence. Now the essence of village life is the family, living as a unit cultivating a certain area—greater or less according, in part, to the circumstances of the family, but, in part, also, according to the locality. Thus the holdings in the East are, on the average, much smaller than those in the West of the Provinces, and allowance will have to be made for such divergencies. The school will now represent a village, the unit of communal life, composed of families, the unit of private life. Assuming a middle school with a five-year course and the maximum age 17 or 18, the students of the senior class will each represent the heads of the families which will be made up of, roughly, one student from each year, giving in all five members to each family. The school will have approximately sufficient land to provide for each "family" of five *students an area, roughly, equal to the average* holding of the locality. In this community the headmaster and his assistants will play the *role* of the zemindar and his agents. He will apportion the farm lands among the "families," issuing yearly leases at reasonable rents, and the "family" will then cultivate the land under his directions, actually performing the operations themselves. The next year a re-arrangement of students in the "family" necessitated by the head leaving and by the introduction of new admissions, combined with a re-distribution of leases, will give ample opportunity for arranging that each student will obtain practical experience, during his period of residence of each of the crops cultivated.

Before passing to the strictly educational aspect of the course, we may consider this proposal in some further detail. I have said the headmaster will play the *role* of zemindar; he will, if the scheme is to attain its full development, have to play many parts. As zemindar, I have stated, he will issue leases at reasonable rents. It is not proposed that those rents should necessarily be paid. The headmaster should also organize the school as a co-operative society, of which the individual heads of families are members and from which the rent can be advanced. Reality can be given by the payment of a nominal sum by each "head" for membership, but the rent and most other transactions, being dues to the headmaster, may be book entires merely. Produce would be similarly pooled for disposal on co-operative principles and may even be nsed to supply a co-operative store to supply the necessaries of life of the students. If payment be actually made by each student or by each "heads," a nominal bonus may be given, otherwise the transactions will, throughont, be nominal as regards cash values, but in all respects should conform with reality. Thus, the amount shown to the credit of a "family" for produce received should be based on the actual sum for which the produce was disposed.

The above constitutes what I may term the environmental aspect of the school; the educational aspects may now be considered. This is an aspect *which, more than any other, suffers from the danger of dogma*, and, in the present case, it in no way differs from the general problem as it appears in all educational institutions. It is a problem to which each individual will offer a

different solution depending on his particular personal bent. Such solution as I shall offer is, therefore, of necessity so coloured. Education as found in this country fails in two directions—the first, practically; the second, accuracy. With the former I have already dealt: the whole organisation of the environment is aimed at developing this character. The latter must be developed in the class-room. For this purpose the following subjects seem best fitted: mathematics, associated with which may be book-keeping and accounts, and elementary physics. With these subjects emphasized, the remainder of the course will be composed of those subjects which form the basis of the curriculum of the ordinary school, preference being given to subjects which have some association with the life the students lead. Care, however, must be taken to teach each as a balanced subject without undue prominence given to their supposed practical aspects. Among such subjects, I should place English, geography, physiology and elementary studies of plant life. In the above course—and it is not desirable to go into greater detail at present—my main object being to develop principles rather than detailed schemes, the only direct point of contact between the environmental and educational sides of the school lies in the acconnts, for which the books of the institution may well be used to provide practical examples. A comparsion of this outline with, for instance, the curriculum of the Loni School, will bring into prominence the difference I have tried to emphasize.

A pupil taking five years to pass through such a course would thus gradually imbibe the practical aspect of agriculture; would be gradually introduced to those conditions which tend to place the cultivator in a position of sturdy independence and self-relianc-aud should by the end of his school career, be fitted to return to his home and the reality of life with a sense educated to realise the more backward conditions and a will to remedy them—a condition of mind and body suggestive of a career as a useful citizen. The information will, moreover, be learnt by a process of absorption from constant association, one of the essential conditions if the soundness of my contention is admitted.

There remains the question of cost, the question whether the scheme will satisfy the second or financial consideration, which it must do if it is to justify the expenditure of public funds involved. With thirty students in each class, a school of 150 will be formed for which are area of 150 acres' cultivation will be required if each holding is calculated at 5 acres. As most of the labour will be provided by the students, the labour bill will be small and the profit on cost of production should be considerable. In addition, there will be the capital capital chsrges and the cost of instructional staff. The former will be larger, but the latter not necessarily greater than the same charges of a school of the same standing but of the usual type. The unknown factors at the present stage are two numerous to make it possible to draw up a balance sheet which would approach any degree of probability to the actual, but it seems more than probable that the cost would be, on the balance, low. One point at any rate is clear; unless the form is working at a profit, and a handsome profit, it will not be fulfilling its function, and we have here, therefore, a very simple and practical test.

One point remains to be considered, and it arises from what I have said early in this article, in bringing out the difference between the coach and the teacher. However good the system is, it will never succeed in producing the desired result unless the agent, in this case the teacher, is competent to develop its potentialities. The aspect requires no enlargement, as its essential nature appears to be fully recognised and formed the subject of much discussion at the Simla Conference. For the present purpose it is sufficient to point out that the snpply must be derived from the Agricultural College and forms a third legitimate field, additional to the two already described, of activity for the college.

The proposals outlined above constitute a scheme for providing for the educational needs of the largest section of the community, and, as far as considered, suffices for the main educational function, to fit the average youth for a useful and contented life in the conditions under which he was born. There remains the second aspect, without which no educational system can be considered complete, that of providing a ladder by which those intellectually qualified can a rise. If such a ladder is to be provided it follows that a system of secondary schools leading to the University or to the Agricultural College must be introduced. On this subject, the Simla Conference showed considerable diversity of opinion, and the probability is that the exact direction in which this will develop cannot be forecasted with any degree of certainty, and will depend on the exact form of school that is found to succeed. I will content myself with noting a single point. The type of school I have outlined contemplates the performance of the field-work by the pupils each holding and possessing a body of pupil labourers of decreasing age. If such a scheme is to succeed, and the practical work is to be carried out with that efficiency which will alone ensure success, the oldest pupils must have attained a physical development enabling them to do the more arduous field labours.

That consideration would seem to indicate that greatest efficiency will be developed in those schools where the age-limit is relatively high, and hence that the type is best adapted to schools of the secondary class. The absence of the necessary physical power in the students of the Loni School was one of the points that struck me most forcibly in the one visit I was privileged to make to that school. It would appear possible that schools of this type would lead directly to the college, and that the ladder we desire would be provided in this manner. The truth is that the practical difficulties, not the least of which is the absence of teachers, are such that the development of such schools must be slow and will afford ample opportunity for gaining practical experience. It is not desirable, therefore, at the present time to enter in too great detail into such matters. It is essentially a case for trial and experiment, the establishment of a few schools of the type described and their gradual extension in that direction which experience shows to be most desirable. What is essential is a clear comprehension of the fundamental principles which underlie the problem—a comprehension so sharp that it can be used as a test during each stage in the experiment. To the best of my ability I have attempted to supply the material for such a test.

GOVERNMENT TRACTOR CULTIVATION IN ENGLAND AND WALES.

Capt. G. T. Hutchinson, Mechanical Cultivations Commissioner, Food Production Department, writing in the *Board of Agriculture Journal* for December, 1918, says:—

In order to appreciate properly the part played in British agriculture to-day by the tractor, and its possibilities in the future, it is essential to consider briefly the history of the tractors operated by the Food Production Department—the so-called Government Tractor Scheme. Without this information, misleading conclusions might be formed, and full value could not be obtained from the lessons taught by the Government Tractor.

INAUGURATION OF THE SCHEME.

The scheme was instituted at a moment when, in consequence of submarine warfare, it became necessary to grow as much corn as possible, and to grow it against time, in the British Isles. To carry this policy into effect throughout the country, some increased and more rapaid means of cultivation than those hitherto in practice were demanded. Even if sufficient horses had been available their work was too slow for the emergency; further, every team of horses required a man, and sufficient men could not be found. Nor could increased steam tackle meet the difficulty, for additional sets could not be procured quickly, and corn could be grown in many parts of the country where the geograhpical conditions made the use of steam tackle impossible. The Government, therefore, resorted to the tractor, which could operate in Districts where steam tackle could not, and which required less labour and covered more ground than horses.

THE SCHEME ITSELF.

In these circumstances, little use could be made of the experience gained with the few privately-owned tractors in the country. It was considered necessary to purchase tractors of all types, wherever they could be found, to set them to work at once, and to deal with the question of suitable types and the renewal of worn parts as soon as the situation should permit. A beginning was made late in the spring of 1917, and the scheme was rapidly developed. In order to utilise the tractors to the fullest extent possible, some system of centralised control had to be improvised, and at the same time local arrangements had to be made for working them, and keeping them in repair. These facilities were supplied by the mechanics and repairing shops of the motor trade, which was, in effect, entrusted with the local management, under the control of the Food Production Department. Tractors were received by each county as they became available; the Tractor Representative for the county, acting in concert with the Agricultural Executive Committee, arranged their work; they were manned mainly by soldiers from the Agricultural Companies; and they were kept running by the proprietors of the provincial motor garages.

Their task was to plough land at all costs, and the initial difficulty was to overcome the reluctance of the farmer to employ an untried and suspected means of cultivation. They could not wait for suitable weather or suitable land; the position was like that of a new business, where orders must be canvassed for, unremunerative contracts accepted, and a supply created, in the hope that it will create a demand. Such was the preparation by the Government tractors for the 1918 harvest. After the completion of the spring cultivation, it became possible to place the scheme upon a more workable basis. At one time, more than twenty types of tractors were employed by the Government, and the inconvenience and frequent impossibility of providing spare parts and repairs for each type constituted a serious handicap. Within the past few months it has been possible to

reduce the types to six, and to ensure the supply of spare parts, so far as war conditions permit. It has also been possible to decentralise the scheme, and to hand over to each County Committee the control of the tractors allotted to it. In several counties a further advance has been made by loaning the tractors to individual firms to operate as a private enterprise, subject to such control as the County Committees consider necessary. Experience has shown that with tractor ploughing, as with other forms of business, better results are obtained by private enterprise than by Government employees. It has also been possible to release tractors for sale to individual farmers, and since the beginning of this year some 3,000 to 4,000 tractors have been disposed of in this way.

RESULTS OF THE SCHEME.

To summarise briefly the results of the scheme, it may be said that it has fulfilled its object. It enabled County Committees in every instance to carry out their programmes for increased corn production; it assisted them to reap their harvest; and it has introduced a new and highly efficacious means of cultivation to the farmers.

To form a proper estimate of the capabilities of this instrument, however, a careful distinction must be drawn between the tractor of the Government scheme and the tractor in the hands of the farmer. The farmer was employed as an emergency measure; in consequence its work was often imperfect, labour was wasted in connection with it, and operating expenses were high. In the hands of the farmer, on the other hand, the tractor economises labour and does the work cheaply. It would be most unfortunate if agriculturists should be tempted to base their opinion of the merits of the tractor solely on their experience of the tractor scheme.

DIFFERENCE BETWEEN THE GOVERNMENT AND PRIVATE TRACTORS.

The points of difference may be conveniently grouped under five headings:—

(1) *Working Expenses.*—The first of these points concerns working expenses. The exigencies of the situation required that the Government tractors should be available wherever they were required. They were, therefore, grouped in units of (in most cases) ten tractors, each unit serving a wide district. Steam tackle working under similar conditions would move from farm to farm as a self-sufficient unit, complete with plough, cultivator, and cabin for the crew; the farmer would have fuel and water ready in the field. The tractor, however, cannot haul its own fuel supply, and, under war conditions, the farmer cannot provide it. Petrol, paraffin, and grease must be delivered daily in a light motor-van: this method is expensive, but delivery by horse transport would be too slow, and a motor-lorry could not reach the inaccessible fields in which so many of the tractors are employed.

In cases of mechanical trouble, a mechanic must be summoned from the head-quarters of the unit to effect the necessary repairs. From time to time a supervisor of some sort must also visit the tractor, to see that the men are working, and that the ploughing is satisfactory. With the privately owned tractor these officials disappear; the farmer keeps the fuel in his coach-house, supervises the work himself, and avoids the necessity of frequent repairs by taking care of his tractor. If bad weather stops the work, he can find another job for the driver, but the drivers for the 4,000 Government tractors, scattered in billets all over the various counties, often spend an idle day.

(2) *Repairs.*—The second point to be considered is the question of repairs. Most of the tractors operated by the Government were built in America, where paraffin as a fuel is little used. The engine is designed to burn petrol or petrol substitutes, which are drawn off from the crude oil because of their volatility. Paraffin is a by-product of these oils and is not actually a volatile fuel oil. It has to be made so by means of an atomiser and superheaters, before being introduced into the combustion chamber. Time and experience are now meeting the difficulty, but last spring the work of the Food Production Department would not be delayed. Petrol could not be spared, but paraffin was available. Tractors were hastily adapted and worked with paraffin, and in some cases this has resulted in excessive wear of engine parts and consequent engine trouble. Competent mechanics have not always been obtainable when required, and the supply of spare parts, in war time, in sufficient numbers for the Government tractors, has been a perpetual difficulty. The critic who concludes that the tractor is no good, because he has seen one standing idle for weeks in the field, should enquire whether it is in fact waiting for a spare part which lies at the bottom of the Atlantic! The peace-time tractor will not suffer from this handicap.

(3) *Nature of the Work.*—A third point to consider is the difference in the nature of the work which the Government tractor and the farmer's tractor are required to perform. For various causes, which it is unnecessary to discuss here, in nearly every part of England some very unsuitable grass land has been ploughed up within the past twelve months, and the most unsuitable has usually been allotted to the Government tractors. Much of this work has not been ploughing, but reclamation. The Government tractors carried out some astonishing

performances last spring. They dug themselves deep into the Midland clay, they broke implements innumerable on the concealed rocks and boulders of the west country, and they skidded vainly about the hillsides of Wales and the North. Fatal accidents were not unknown, but land was ploughed—at a cost—and crops were grown: it was "magnificent, but not agriculture." No doubt this reclamation work has already justified itself, and the average farmer will not purchase a tractor to reclain land, but to plough.

Government tractors were also operated in typical grass counties in the Midlands and in the West, where each farmer had sacrificed one field to the good cause. Here the fields themselves might be suitable, but the amount of roadwork involved in going from farm to farm, with consequent high fuel consumption and wear-and-tear to the tractor, made economic working impossible. This difficulty will not apply to the farmer's tractor.

(4.) *Labour.*—A fourth point of difference is labour. At the end of the spring cultivation in 1917, the Food production Department was operating about 600 tractors; at the same period in 1918 it had over 4,000. Drivers had to be found and trained from such material as the exigencies of war left at the disposal of the Department. When the Government tractors are disposed of, these men will be available for the farmers, and already measures are being taken to assist the training of drivers for privately-owned tractors. The farmers will at least be able to select a suitable man to train for his tractor, but the Food Production Department was never in a position to pick and choose. A most encouraging feature is the excellent results so frequently achieved by the hastily-trained Government drivers, and the satisfaction which women drivers have given in so many counties.

(5.) *The Implements Used.*—Another advantage which the farmer's tractor will have over the Government tractors is that the farmer will be able to attach it to the plough or cultivator, which is most suitable for his particular requirements, whereas the Government tractor is limited to such implements as are now available. In nearly every part of the country the experience of generations has evolved a special plough, cultivator, or harrow, to deal with local peculiarities of soil or cultivation, many of which are manufactured locally. In war-time the out-put of such implements is limited, and if all are commandeered by the Government, the demands of private purchasers cannot be met. It has, therefore, been necessary to purchase implements in bulk for use with the Government tractors, largely in America, in order to carry out Government cultivation without unduly curtailing the supply available for individual farmers. It is, however, unreasonably to expect that their work should be equally satisfactory in all localities. One type of Oliver plough made to turn a wide furrow has proved unsatisfactory on hard ground, until converted to turn a narrower furrow. In some counties a heavier cultivator than those cultivators now obtainable is demanded. In these cases it is manifestly unfair to condemn the tractor because the right cultivator's implement is not obtainable, and the work has suffered in consequence.

POSSIBILITIES OF TRACTOR CULTIVATION.

It remains to consider what profitable conclusions can be drawn from the experience of the Government Tractor Scheme as to the possibilities of tractor-cultivation in England.

In the first place it is established that to obtain the best economic results from the tractor, it should be in the hands of the farmer, and should not leave his farm, except, perhaps to assist his immediate neighbours, in cases where such an arrangement is possible. Though there is no doubt that tractor-ploughing firms will be started, to carry out work on the same lines as the existing steam-ploughing firms, the difficulties of fuel supply, roadwork, and supervision, must always place this system at a disadvantage, when compared with the privately-owned tractor.

Work Done.—Sufficient has already been said to indicate that the acreage results achieved by the Government tractor must not be accepted by prospective purchasers as a final test of their capabilities. The statement of weekly averages in the counties, circulated by the Department, shows that few counties are able to maintain an average of ten acres ploughing per week per tractor in commission, or a fuel consumption below five gallons per acre. In nearly every county, however, a Fordson tractor, with a self-lift plough, has ploughed five acres in the day under favourable conditions, in the hands of one reasonably competent man or woman. The same tractors have frequently cut upwards of fifteen acres in the day with a binder, which would not be exceeded by two teams of three horses working in two shifts. The fuel consumption of the farmer's tractor should be in the region of three gallons per acre ploughed.

Quality of Work.—It has also been proved in every county that the quality of the work done by tractors can be perfectly satisfactory. It serves no useful purpose to compare their work with that of horses or steam tackle; because all three will be required; it must depend on circumstances in each case which method can be, or should be, adopted. Plenty of bad work has been done by the tractors, the reasons for which have been fully explained. The best testimony in their favour is the verdict of

the farmer, and whereas a year ago it was necessary to canvass for orders for work for the limited number of tractors available, to-day, in practically every county, the tractors are scarcely able to carry out the daily increasing number of contracts for ploughing.

Quick Work.—It is now realised that the tractor enables the farmer to cultivate at the right time, and the importance of this is appreciated by every practical farmer. Theoretically, if a man has the requisite "strength" for his farm, he should be able to keep it employed throughout the greater part of the year, and to carry out the successive operations of husbandry, each in its proper course. In practice climatic conditions make this impossible. One operation is delayed by the weather and subsequent operations suffer.

The broad distinction between the bad and the good farmer is that the farmer is usually in arrears and the latter beforehand with his work, because he has a reserve of "strength" to meet these emergencies. The tractor provides a reserve of cultivating strength which eats nothing and costs nothing when it is not employed. For example, during the past summer many farmers were able to employ all their horses for leading their earliest corn crops, while the later ones were being cut with tractor and binder, and by this means to complete their harvest before the weather broke. The same men could then plough their stubble with the tractor while their horses were still leading the later corn crops. Their neighbours, without this additional "strength," have had corn spoilt and have afterwards had to spend idle weeks waiting to plough their sodden stubbles. There is always a certain period of the year when the soil is in the improper state for ploughing; it is then possible to plough better and deeper, leaving the ground in good condition for subsequent cultivation, and for preparation of the seed bed which will give the best yield. If this opportunity is lost because the normal strength of the farm is otherwise employed, it cannot easily be recovered—on heavier soils it may mean a year's delay—but with the tractor it need not be lost. It is a notable fact that in some counties, in spite of the wet autumn, work on the farms is actually more advanced to day than it was at this time last year—thanks to the tractor.

TYPES OF TRACTORS.

It is often asked, which is the best sort of tractor to buy? The Food Production Department have employed more than twenty different types, all of which have had their good and bad points. Six types have now been retained, but it must be remembered that, in eliminating, the possibility of ensuring an adequate supply of spare parts for the types retained was an important consideration. Of these, the "*Titan*" has done excellent work under the most variable conditions. It has ploughed on the Devonshire hill-sides and in the holding clays of the Midlands, and it has been used as a stationary engine to thresh, to cut chaff, or work a saw. The main improvements which have been made in some cases are a better fore-carriage, and special spuds on the wheels to hold on slippery ground.

Another "general utility" tractor is the "*Overtime*," and many of these tractors have now been in the hands of private owners for upwards of a year, and have given satisfaction.

The "*Clayton Shuttleworth*" is a powerful and more expensive tractor, which has been found especially suitable on heavy clay land, as the pressure on the land is considerably reduced by a "caterpillar" track. It is the only tractor of this type now operated by the Department.

The "*Saunderson*" is another British-made tractor, which has the advantage of a winding drum, and has therefore been in request for threshing as the drum enables it to haul a threshing box up a steep pitch in a country lane. It has been found more satisfactory than other tractors for road-work.

The "*25 H. P. Mogul*" is a heavy tractor, employed mainly for threshing but in some counties it has done a lot of work with the plough, while the land was in suitable condition. It is too heavy for use in wet land.

The "*Fordson*" tractor is probably the cheapest tractor on the market, and, if its limitations are recognised, it is the best labour-saving device which the farmer can obtain. It is the only Government tractor equipped with a self lift plough, and can, therefore, be worked by one man. It is not yet a "general utility" tractor, as it may prove to be too light to be used effectively as a stationary engine, but for the purpose of cultivating it is an acknowledged success. It is often said that it is unsuitable for heavy land, but its success in Essex and other heavy-land counties has led its adherents to believe that, when heavy land is in the proper condition for ploughing, the Fordson can plough it, and when it is not, it is the best to leave it alone. No less than 2,500 of these tractors have already been purchased by private owners, a fact which indicates the farmer's opinion of its merits. For some time its reputation suffered because the No. 7 Oliver plough turned a 14-in. furrow, which in many cases proved unsatisfactory. This plough has now been converted to turn a 10-in. furrow, with the best results, and two other types of Oliver plough, one of them specially adapted for ley-ploughing, will shortly be on their trial in the counties. Other improvements now being carried out by the Department are the

provision of a "governor" for the engine, a break for roadwork, and a "release" attached to the draw-bar, to prevent accidents in case of the tractor rearing up. In some cases, too, it has been found necessary to alter the strakes in the wheels in order to gain a better hold on slippery ground.

HOW TO SELECT A TRACTOR.

Unquestionably the proper course for a prospective purchaser to adopt is to examine the work of his neighbour's tractor, or of the different types of Government tractors in his county, before making his selection. He should have no difficulty in obtaining full information from the officials employed by the Executive Committees of his county, and by this means he can see and judge for himself which type is best suited to his particular requirements. He should also remember that the implement is just as important as the tractor, and can form his own opinion of the former by examining the various makes now utilised by the Executive Committees. For example, the work of the disc cultivator, and of other new implements, may be inspected with advantage. It may be added that, though tractors will undoubtedly be improved, it is better policy under present circumstances to purchase one of the reliable tractors now available than to wait for a perfect type. It is vain to hope for a tractor which will be equally good for cultivation and road haulage. Presumably the motor-lorry represents the best type of internal combustion engine for roadwork, and it is impossible to imagine any form of motor-lorry which could be utilised with a plough.

If British agriculture is to derive full advantage from the experience of the Food Production Department, much can be done by the Executive Committees of the countries. These Committees have recognised that the Government tractors must work primarily for those farmers who could not cultivate under present circumstances without assistance and that applications for tractor-ploughing received from farmers, who should be in a position to cultivate for themselves, must be deferred. The latter should purchase their own tractors or more horses. It is to be hoped that the time is not far distant when all famers will be in a position to dispense with Government cultivation. Meanwhile, Committees can place at the disposal of the farmers the experience gained with the different types of tractors and implements employed in their county.

The writer of these notes has prepared them after seeing something of the work of the Government tractors in practically every county in England and Wales, and after discussing the difficulties encountered and the results achieved, with those who have operated the tractors since the inception of the scheme. Any points which may be described as technical have been carefully verified by the experts employed by the Food Production Department. Though criticism of the tractor scheme is by no means unknown, there are no two opinions as to the value of the work of the tractors, and it only rests with the farmer to take advantage of what is probably the widest form of practical demonstration ever carried out by an Agricultural Department.

SPEECHES AND PRONOUNCEMENTS.

THE UNIVERSITY IN NATIONAL LIFE.

Mr. Fisher's vision of the Future.

The Master of Balliol (Mr. A. L. Smith) presided over a large gathering in the Sheldonian Theatre, Oxford, recently, when Mr. H. A. L. Fisher, President of the Board of Education, delivered an address on "The Place of the University in National Life." The meeting was convened in connexion with the Barnett House Conferences. Among those present were Mr. J. A. R. Marriott, M. P., the President of Magdalen, the Warden of New College, the Master of University, and the Warden of Keble.

The Chairman said he felt certain that Mr. Fisher, more than anyone, held the key of the present situation. They could not expect a permanent satisfactory settlement of the international situation, or of the home situation, the industrial and economic situation, without a better-educated people.

Mr. Fisher, in the course of his address, said that our system of public education had been transformed by the Acts of 1902 and 1918, and the State had now begun to exercise a powerful influence in the direction of scientific research. At the same time, there had been a great increase in the valuable extra moral work conducted by the universities, which had now taken upon themselves the burden of providing education of a university character for men and women who had missed their opportunities in early life. The war had brought into clearer relief the fact that the universities and technical colleges had stood for a great deal in the national equipment during these times of stress and strain, and the largest drafts had been made upon their resources, energy, and good will. No fewer than 30 university laboratories were made use of in 1918 in a single department of warfare. The fact that the State had become conscious of the value of the university as an integral constituent of national power acquired more and more significance. He

welcomed the tendency towards co-operation between universities as to policy. They could not be content to leave events to the blind play of competition, and he should be very sorry if the deciding factor should rest with the Government.

It would be more wholesome and more in accordance with the academic life if the policy of the university development for the whole country were to be shaped in the interests of the whole country and upon the future of national needs by the universities themselves. But if it were to be really fruitful it must not be confined to the rare occasions upon which joint action might be compelled by some international exigency or great departure in academic policy; it should be a continuous priniciple of academic management.

EFFECT OF NEW LEGISLATION.

The new legislation would affect the universities in three ways. Presumably it would fit a great number of men and women for university life, and so increase the number of candidates for the bachelor's degree. It would certainly create a greatly increased demand for teachers in State-aided schools all of whom would, it was to be hoped, at some time or other, come within the influence of the universities. Lastly, it would creat a new "clientele" for extra mural university teaching. From every quarter reports had come in that the boys and girls who had left school for munition work had on their return to educational work greatly deteriorated, had become very difficult to manage and very much coarsened by their factory work. All that would be greatly changed by the development of cheap secondary schools, and by the introduction under the Act of 1918 of a system of part-time day continuation classes. Some part-time classes had already been established in advance of the obligations created under the Act, and so far as he had been able to observe they had been a brilliant success, and he belived that 30 years hence that reform would be found to have been profound and all pervasive, for it would have stamped the university on the consciousness of the people as a democratic institution open to all, and spreading its influencee over the whole surface of national life. There was another territory which might be occupied by men trained in the liberal discipline of the universities, with ample profit both to themselves and to the community—the county and municipal services.

COTTON COMMITTEE'S RECOMMENDATIONS.

The Salient Points.

The report of the Indian Cotton Committee which has just been published is signed unanimously. The committee says: "We have divided our report into two parts, the first of which deals with the agricultural and irrigational aspects of cotton cultivation and the second with the commercial aspect, but in conclusion we wish to emphasize as strongly as possible that the recommendations in both parts must be treated as an organic whole. It is of little avail if the Agricultural Department evolves pure or improved strains of cotton, increases the outturn by the introduction of improvements in agricultural practices, and ensures cleaner methods of picking, or if the Irrigation Department provides facilities for the extension of the cultivation of cotton, unless the cotton produced is marketed in a condition which enables it to secure its proper price and unless the cotton trade pays that price for it. We have pointed out that the cotton trade is not in a position to cope with the numerous abuses which have been so detrimental to the reputation of Indian cotton in the past, without assistance from the Government, and that a policy of *laissez faire* in such matters is no longer possible or desirable. The recommendations we have made in the second part of our report are, therefore, in every way as important as those in the first part if real improvement in Indian cotton is to be obtained. If the proposals we have made in both parts are accepted, the future of Indian cotton will be in the hand of the trade.

THE FUNDAMENTAL ASSUMPTION

on which we have acted throughout is that there is a genuine demand for long staple Indian cotton and that the trade is willing to pay a sufficient premium for it to make it worth the while of the cultivator to grow it but that there have been various obstacles in the past which have prevented it from doing so. We have submitted proposals which will remove those obstacles and will enable long staple cotton to compete with short staple cotton on its merits. It will, therefore, rest with the cotton trade to convince the cultivators in the only way in which he can be convinced that long staple cotton pays him better than any other varieties. If it succeeds in doing so, as we trust it will, India will be able to make no mean contribution to the resources of the Empire."

The report issued is a bulky volume of 200 pages and contains several maps. Each province has a separate chapter devoted to its conditions and at the end of each chapter are the committee's recommendations and conclusions. Touching the function of a

CENTRAL COTTON COMMITTEE,

the report states that in order to secure the co-ordination and co-operation in all matters relating to cotton, a central cotton committee of a permanent character, composed of representatives of the agricultural and co-operative departments, the director-general of commercial intelligence, the director of statistics and representatives of the trade should be established with its head-quarters at Bombay. The agricultural adviser to the Government of India should be the president of the committee, the staff of which should include a whole-time secretary, and a technologist. The main functions of the committee would be to act as an advisory body to Government and the trade on all matters connected with cotton, including questions relating to legislation and the licensing of ginning and pressing factories, to act as a centre for the dissemination of information regarding cotton and to assist the agricultural department through its technologists in obtaining authoritative valuations of new varieties. In order to carry out its functions the committee would act through and with provincial committees and local sub-committees. Such committees would be formed in all the provinces in which cotton is grown, except Bihar and Orissa and Assam. In view of the special circumstances of Burma, the provincial committee in that province would be the advisory body in regard to the licensing of ginning and pressing factories.

The Post of an Imperial Cotton Specialist will cease to be necessary on the formation of the central cotton committee and should be abolished on the retirement of its present holder. Samples of cotton submitted by the Agricultural Department for trade valuation, should, in the first instance, be not less than twenty pounds of lint. If the report on ores is satisfactory 200 pounds of the cotton thrown on a field scale and handled under ordinary conditions should be sent for a mill test. Dealing with

THE WORLD'S POSITION

in regard to cotton, the report says: The total world's production in pre-war conditions is estimated by Professor Todd at about 25½ million bales of which the United States produced 15 million bales.

The Amercian crop, forming as it does very nearly three-fifths of the total outturn of cotton, is, therefore, the predominating factor in the world's markets. During the first three years after the war broke out, it averaged only 13½ million bales whilst the crop of 1917-18 was estimated at only 12 million bales and that for 1918-19 is estimated at 12½ million bales.

Table 4 in appendix 2 shows the very striking increase in the proportion of the crop consumed by American mills.

Whereas in the quinquennium, 1890—95, it averaged only to 2,758,000 bales out of a crop of 8,346,000 bales or 33·05 per cent, in the quinquennium 1910-15 it averaged 5,769,000 bales out of a crop of 14,558,000 bales or 39·63 per cent. For the three years 1915-18, it averaged 7,600,000 bales out of a crop of 12,871,000 bales or 59·14 per cent. It is evident, therefore, that unless fresh sources of supply are rapidly developed, the high prices of cotton, at present prevalent, are not likely to fall to any appreciable extent even with the return to more normal conditions, especially as all the countries of the world will be seriously short of cotton after the war.

In these circumstances it is obvious that

THE LANCASHIRE COTTON INDUSTRY

the importance of which to the Empire needs no comment from us, is faced with a serious situation and that it is most desirable that it should cease to be almost entirely dependent on a source of supply, the feature of which is so problematical. It is equally desirable, in the interests of the Empire as a whole, that an alternative source of supply should be found within the empire. India, as the largest cotton producing country in the Empire, and the second largest in the world, clearly offers the greatest possibilities of any considerable increase in the supply of cotton in the near future. Apart altogether from the possibilities of an extension of the area under cotton as the result of high prices or of the provision of irrigation facilities and of obtaining an increase in the outturn by the introduction of superior varieties, the average yield per acre of the Indian crops is only about 85 pounds of lint, whilst that of the United States crop is nearly 200 pounds per acre and the Egyptian crop 450 pounds. The condition of affairs is moreover even worse than is represented by these figures owing to the conditions in which Indian cotton is marked. It has been estimated that Indian cotton loses about ten per cent in the blow room more than the American or Egyptian cotton, thus reducing the real average yield per acre to about 70 pounds. The scope for obtaining an increased outturn merely by an improvement in the agricultural practice is, therefore, considerable. Of the average annual Indian crops of between four and five million bales, very little is at present used by Lancashire as is shown by the fact that the average exports to the United Kingdom for the five years ending 1917-18 were 2,15,000 bales only, of which a large amount in regard to which we have not been able to obtain exact figures, was re-exported. As far as Lancashire is concerned, the immediate necessity is an extension of the cultivation of long staple cotton in India. The problem is no new one. It has occurred to the attention of the Government of India since 1788 but whereas the efforts to extend the cultivation of cotton, more especially of exotic

varieties during the early part of the last century, had, for their object, to render Lancashire independent of the American supply, the position now is that India herself has a flourishing cotton industry, which is interested equally with Lancashire in the question of obtaining larger supplies of better cotton. The tendency, already visible before the war in this country in the direction of spinning higher counts up to 305 twist has, we understand, become much more marked during the last two years, and there is every reason to believe that the advance in this respect will be maintained when the war is over. All the evidence submitted to us by the representatives of the manufacturing interests in India emphasized the importance which the Indian cotton industry attaches to the development of long staple cotton in this country.'

The committee next discusses the possibility of

INDIAN COTTON REPLACING AMERICAN

for Lancashire purposes, and says: 'It is perhaps desirable that we should, at the outset, state our views as to the possibility of growing in India, cotton of sufficient long staple to meet the requirements of Lancashire, and to replace American cotton in the Lancashire mills. It is a matter of common knowledge that the cotton trade practically originated in England and that at one time the export trade in manufactured goods was almost entirely in the hands of Lancashire. Owing to the development of cotton manufacture in other countries the Lancashire spinners have been compelled to confine themselves in an increasing degree to finer counts for which longer and finer qualities of cotton are required. The results of our enquiries as to the cottons grown in India which are suitable for purposes of Lancashire are shown in the table appended to this chapter. We are of opinion that the only parts of India from which assistance of real value to Lancashire can be expected in the near future, except in the important matter of hosiery yarns, to which reference is made in the next paragraph, are the tracts in which cotton of an inch or slightly more in staple can be grown in larger quantities. It will be seen from the table appended to this chapter, and from the subsequent chapters of our report, that the only tracts which answer to this description at present are those parts of Madras in which Cambodia and Karunganne cotton are grown and the Punjab where American cotton is making rapid headway. If the new varieties at present under trial in the latter province can be successfully established it will fulfil the necessary coditions to a greater extent than it does now. Egyptian, and American cottons have been sucessfully grown in Sind in spite of difficulties and we consider that cotton of both these types of a quality better than any grown in the Punjab and U. P. to 1⅛ inch in staple could be grown in that province with ease provided that perennial irrigation were insured by the construction of the Sukkur barrage, a point with which we have dealt in detail in chapter VII.

OUR CONCLUSION

is therefore that India cannot, for at least ten years, grow cotton in any large commercial quantity of a staple longer than $\frac{1}{16}$th inch. Up to this length we think Madras might furnish 500,000 bales and the Punjab 200,000, bales but these cottons will only be capable of spinning up to 34s. twist and 44s. twist in the Lancashire mills if the conditions in those mills continue as at present. We think, however, that there will be a demand from Lancashire for cotton, for spinning counts up to these degrees of fineness for a very long time to come. We would add that every extra bale of long staple cotton, as the term is understood in this country, will liberate a corresponding bale of other growths for Lancashire and that therefore the proposals we have made with a view to securing an increase in the Indian crop will tend equally to the advantage of Lancashire and Indian industries.

MAN AND HIS DIET.

The report of the Food (War) Committee of the Royal Society (which has just been issued by the latter) on the food requirements of man and their variations according to age, sex, size, and occupation, although it concludes with the confession that it "shows how very inadequate is our present knowledge of the science of nutrition, and demonstrates the necessity of renewed investigations of almost every point discussed in it," contains much information of interest.

Taking as the average man one between the ages of 25 and 50 years, weighing unclothed 10st. 5lb. 5½ft. 7·4 in. in height, and performing eight hours average work in a climate such as that of France or England an attempt has been made to estimate his expenditure of energy under varying conditions of employment and the amount of food which he will require to replace the energy expended in the course of the day.

Nearly the whole of the food taken by man, it is explained, is oxidized in the body, and in the process of oxidation energy is given out, most of which

appears in the form of heat which serves to keep the body warm, while the rest supplies the energy for muscular movement. If the total energy given off by a man in the course of a day is known it is sufficient to give him a food yielding the same number of utilizable calories in order to cover entirely the requirements of the body.

The basal metabolism of the average man, which is defined as the metabolism or total oxidation changes of a man under ordinary conditions of nourishment but with the body and digestive organs at rest, is shown to equal 397 calories per square metre of surface per hour, or 1,687 calories per 24 hours. By measuring the excess of energy expended during eight hours work over that expended during eight hours of sleep, an attempt has been made to estimate the additional calories required by men in different occupations. For sedentary work these are placed at less than 400, for light work 400 to 700, for moderate work 700 to 1,100, and for heavy work 1,100 to 2,000 calories. Certain estimates are given of the probable requirements of men engaged upon different classes of work, but in view of the scanty experimental data available, the committee issue a caution with regard to the use to be made of them.

INFLUENCE OF EXTERNAL TEMPERATURE.

The influence of external temparature on the food requirements of the body is touched upon, but the statistics, which show that there is an increase of 10 per cent in the total bread and meat eaten in the winter months as compared with the summer months, being based upon figures during the war are given rather as showing the kind of knowledge which may be available in the near future than as conclusive proof of the needs of man.

It is pointed out that the influence of external temperature is minimized, in that man reacts by warming his workrooms and dwelling houses, and by putting on more clothes so as to hinder the escape of heat but as a general rule classes of individuals exposed to cold and wet would need an increased allowance of food apart from the nature of their employment, and in allotting an average ration to any class of worker the question of exposure to the open air and to cold should be taken into account.

NEEDS OF WOMEN AND CHILDREN.

The basal requirements of a man depending on the extent of his body surface, a big man requires more food than a small man doing the same work, and an elastic reserve should be provided where men receive a fixed diet unless the ration is placed so high that it suffices for the largest-sized man and is more than sufficient for the average and small men. It is estimated that the average man requires 3,000 calories a day, and the average woman, whose work is estimated at about two-thirds that of the average man, requires about 2,500 calories.

The food requirements of children based on basal metabolism, rate of growth, and bodily movements, still require, it is stated, careful investigation before reliable figures can be given. The statistics available show, however, that the amount of energy expended per unit of body surface is much higher in the case of children than in adults. The basal metabolism of a child aged 6·5 years is given as 57·5 calories, aged 12·6 years as 48·7 calories, aged 13·7 years 47·3 calories, aged 16·5 years 43·9 calories, and aged 19·25 years 40·7 calories, that for an adult male being 39·7 calories. The Committee say :—

It will be necessary, before expressing a definite opinion on the actual requirements of growing children and adolescents, to obtain more data from schools where the pupils' consumption is kept separate from that of the staff, and where an accurate record is kept of the pupils' weights so as to ensure that under the diets in question growth was normal. It is a significant fact that in many of the schools it was lately found necessary or desirable, in consequence of the food restrictions, to abolish morning school before breakfast, or to diminish the amount of time spent on games. There seems little doubt, therefore, that the growing lad between 15 and 18 if giving full scope to his ordinary muscular activity requires an amount of food even greater than that assigned to the adult manual labourer, and that the girl up to the same age requires not less than working woman. Any difference between the requirements of the boy and the girl up to the age of 18 is determined rather by the difference in their muscular activity than by the metabolic habit of their tissues. If the daily life of the girl is compulsorily made as active as that of the normal boy, her requirements for food will be as great as those of the boy, apart from the difference in size and weight. The inferiority of the woman in the last two factors will only make itself felt from the age of 15 onwards.

BRAIN WORKERS' ENERGY OUTPUT.

With regard to the large class of the population earning their living in sedentary occupations, in which the movements of writing are the only muscular exertion involved, whether this consists merely in copying figures or addressing envelopes, or involves obstruse calculations or difficult composition, the most careful experiments have failed to show any increase in the energy output of the body as a direct result of brain work. A brain worker, therefore, requires no more food, as estimated in calories than would correspond to his

basal metabolism, with the 30 per cent extra due to muscular exercise voluntarily undertaken for health or recreation.

The quality of the brain worker's diet requires rather more consideration than that of the bodily labourer. In order that mental work may be carried on efficiently it is essential that the process of digestion should not make too great a call on the energies of the body. The food must be degestible and moderate in bulk. In the diet of such a man the more expensive animal foods—meat, fish, eggs, butter, etc.,—should form a larger proportion of the total calories than in the case of the man who earns his living by the work of his muscles.

Experience during the war showed that it was possible for men to live and carry on their normal work on a diet very much less than that to which they were accustomed. The basal metabolism is diminished and the individual is more economical in effort. This seems to have been the condition of the greater part of the urban inhabitants of Germany, who received a daily allowance of food of not more than 2,000 calories. When extended over years, however, the general effect appears to be a diminution in the resistance to tubercular disease. In the case of children the effect has been to restrict growth, but not to stop it.

Experiments on animals, as well as German observations tend to show that a return to normal conditions will probably be followed by an increased rate of growth which will be sufficient to make up for that loss during the past years.

ECONOMIC NOTES.

AGRICULTURE.

The Government of Mysore have issued the following order regarding arrangements for supply of ragi and rice to the poor :—

During his visit to the Mysore City on the 15th and 16th instant, the Officiating Dewan inspected the arrangements for the supply of food grains by the Municipality and discussed the food situation generally with the Food Controller, the Honorary President of the Municipal Council and the Deputy Commissioner of the Mysore District.

2. The situation regarding rice is, on the whole, satisfactory. The supply, on account of the recent harvest, is plentiful and grain is freely coming to the market.

There is, however, some difficulty as regards ragi. The Municipal authorities have opened six depots (One of which is managed by a private merchant) for the sale of ragi, which is issued to ticket-holders at 10 seers per rupee. During February and March about 1,500 pallas were sold in this manner.

But the supply of ragi in the Municipal depots is insufficient and adequate precautions have not been taken to regulate the crowd which gathers at the depots. The ticket system also has not been carefully worked.

3. After discussing the situation with all the officers concerned, the following arrangements have been ordered :—

(i) Government will have to restrict the food distribution in the City to the poorer classes.

(ii) Statistics show that to provide for these classes 150 pallas of food grains are required daily. Seventy-five pallas of ragi and seventy-five pallas of Burma rice will be sold daily through 10 distributing depots to persons who have obtained tickets from the Municipal Office.

(iii) The issue of tickets will be made under a carefully conducted census on the basis of the lists already prepared and the number of tickets, as well as the quantities noted therein, should be regulated with reference to the quantity of grain allotted that is, 150 pallas per day.

(iv) Strong iron rails and barricades should be put in each place to prevent rush and danger to women and children, entrance and exits being guarded by Police men who will insist on ticket-holders only being allowed.

(v) The supply of ragi will be made at 10 seers a rupee and Rangoon rice at 6 seers a rupee.

(vi) The Deputy Commissioner, Mysore, will from now till the end of April, supply to the President a total quantity of 5,000 pallas of ragi according to the detailed* programme laid down to admit of a regular issue of 75 pallas a day, without fail.

(vii) The Food Controller will send immediately to Mysore about 4,000 pallas of Burma rice to the Honorary President for issue at the rate of 75 pallas per day.

*2,000 pallas (including stock already collected) to be supplied before 20th March, 1919.
1,500 pallas between 20th and 31st March, 1919.
1,500 pallas, between 1st and 15th April, 1919.

(viii) Daily reports of distribution should be sent to the Food Controller in the following form :—

	Date	Total received	Total in hand	Total distributed	Number of persons
Ragi ...					
Rice ...					

(ix) One or two additional Food Inspectors to supervise the distribution should be forthwith appointed and necessary police arrangements should be made.

(x) And bills and tom-tom notices should be widely given announcing the places and the arrangements.

(xi) All non-ticket-holders should be rigidly excluded.

(xii) Lists should be carefully scrutinized by Ward Committees to be appointed for the purpose, whose co-operation should be secured for the working of the scheme.

4. The loss entailed by these arrangements will be borne by Government out of the sum sanctioned for the purpose.

The following further order regarding the Distribution of ragi and rice to the poor has also been issued by the Government of Mysore.

Having regard to the acute situation caused by high prices of ragi and the shortage of supplies in the Cities and District Head-quarter towns, Government are pleased to direct that distribution of ragi to the poor in the Mysore and Bangalore Cities and other District Head-quarter towns be immediately organized.

2. In Government Order No. G. 20748-50—P. P. 134-18-428, dated 17th March 1919, orders have been issued laying down a definite scheme for such relief in the Mysore City. The Food Controller is requested to organize a similar agency in the Bangalore City fixing requisite quantities of ragi and Burma rice in consultation with the Honorary President and the Deputy Commissioner, Bangalore District, who is responsible for the commandeering of ragi.

3. Similar action should be taken by the Food Controller in consultation with the Deputy Commissioners concerned, for opening such depots at District Head-quarter towns for sale according to actual necessity. Commandeering should be under the supervision of Sub-Division Officers without exception and the rate fixed according to the prevailing market rate as far as possible, the difference between this and the distribution rate at Government centres being borne by Government.

4. The expenditure under the above scheme will be met by a special grant from the famine reserve.

5. To relieve distress among working classes in rural areas, the Deputy Commissioners are requested to enlarge the programme of village works as far as possible in accordance with instructions given in the Government Order read above. They are also requested to specify the taluks where such relief is most needed and where the rule about raiyats' contributions require to be relaxed.

6. Necessary action may also be taken for opening depots at all Taluk Head-quarter stations for sale of imported rice. Necessary establishments at a cost not exceeding Rs. 30 per mensem for each Taluk Depot that may be opened may be entertained.

FODDER CROPS FOR THE HOT WEATHER.

The Department of Agriculture, Bombay, has issued the following Leaflet (No. 11 of 1918) on Fodder Crops for the Hot Weather :—

During the present famine year the greatest difficulty about fodder both in the Deccan and in Gujarat is likely to be felt from the beginning of May till the latter part of June. It is, therefore, very important to grow fodder crops which will flourish through the hot weather and be ready for cutting at the time stated above.

Such crops are found in certain special varieties of Jowar. *Sundhia* Jowar is the best for Gujarat; *Hundi*, *Kalbondi* and *Khondi* Jowars are the best in the Deccan. *Sundhia* seed is available in freely large quantities in Gujarat, chiefly round Nadiad. An effort is being made by the Agricultural Department to get seed of the varieties suitable for the Deccan, for those who cannot secure it themselves.

In growing these crops, the land should be prepared as for an ordinary *jowari* crop, except that provision should be made for irrigation. As much cattle manure and other refuse manure as can be

spared should be put on the land, and the seed should be sown with a four coultered drill, with nine inches between the rows. The seeding must be thick, and not less than forty pounds of seed per acre should be put in.

Irrigation will have to be frequent, water being applied once in four or five days in the light soils of Gujarat, and once in eight to ten days in the Deccan.

None of these fodder crops can be used without danger until the ears have formed, but after that time they are excellent fodder. *Sundhia Jowar* will reach this stage in about two months: the other *jowars* mentioned will be ready for cutting in from 2½ to 3 months.

The yield of green fodder which will be obtained on fairly good land is from 10,000 to 12,000 pounds of green fodder in the case of *Sundhia Jowar*, and a little more in the case of the other *jowars* mentioned.

DAIRYING.

The Government of Madras have passed orders approving the following proposals of the Director of Agriculture, Madras, for the improvement of dairy business in the Madras City:—

2. A reference is solicited to Bulletin No. 73 of the department—'A Survey of the Madras Dairy Trade' by Mr. A Carruth, the Deputy Director of Agriculture for Livestock—for a description of the existing state of affairs, and to the paper on the *Dairy Trade and its Improvement* by the same officer, which will be found on pages 198 to 207 of the *Journal of the Madras Agricultural Students Union* for August 1918, for proposals as to how this state of things can be remedied.

3. It is useless to expect any improvement until the industry can be put on an economic basis. And the only way to do this is to find a cow that will produce enough milk to pay for its keep and for some profit to the dairyman. There are no signs of any really good milking strains even in the Ongole breed, which is our best local one. Therefore the solution of the problem must be sought in cross-breeding.

4. I do not think that there is any escape from this conclusion. One is confirmed in it by the fact that the Madras milkmen have already sought to solve the problem on these lines. A large number of the milch cattle in Madras are already cross-bred—but this introduction of foreign blood has taken place in a haphazard manner, and there has been no attempt to breed out a good milking strain—*vide* Part VII, page 32 of 'A Survey of the Madras Dairy Trade.' Again the Military have gone in largely for cross-breeding at all Military dairy farms.

5. Mr. Carruth selects the Ayrshire breed as the most suitable for crossing with Madras cows and I think that his conclusion must be accepted. The Military Farms department have imported large numbers of bulls of this breed—I know that at least 30 have been imported in each of the last two years possibly more.

6. Owing to the heavy losses of cross-bred cattle which we experienced at Coimbatore last year, I have hesitated to recommend any scheme which involved cross-breeding. However, as explained in my letter No. R. O. C. 2776-5655-Gl., dated 11th December 1918, I am satisfied that in the method of simultaneous inoculation, as worked out in recent years on the Military dairy farms, we have a sure means of combating rinderpest. We must always expect a certain percentage of loss, but this risk must be accepted because cross-breeding is the only way in which we can hope to bring about any permanent improvement in the milking capacity of Indian cattle.

7. I therefore submit the following definite scheme which has been worked out by Mr. Carruth:

(a) Ayrshire bulls of a good milking strain to be purchased by Government.

(b) These bulls to be kept at suitable centres in Madras town for the service of the milch cattle of professional milkmen.

(c) An upper subordinate of this department to be stationed in Madras to look after the bulls and to get into touch with the milkmen.

(d) In return for the charging of a specially low service fee, the Government to have the option of purchasing the calves at a fixed price.

(e) These calves to be used to stock a Government dairy farm not too far from Madras where cross-breeding would be carried on with a view to the production of a stable dairy breed.

(f) Attempts to be made to start a co-operative society among the Madras milkmen, both for credit purposes, and to encourage them to go in for systematic breeding, co-operative purchase of cattle food, and possibly co-operative sale of milk.

8. The first step to be taken is the purchase of the bulls. Eight bulls will be required altogether if the scheme succeeds. For the present I recommend that four bulls should be purchased this year. They

should arrive at Madras in November next. Mr. Carruth estimates that the bulls will cost £130 each. They should be sent first to the cattle-testing station of the Board of Agriculture and Fisheries, Pirbright. Survey (*vide* leaflet No. 290 of the Board), for being inoculated against piroplasmosis and tested for tuberculosis. On arrival in this country they should be inoculated against rinderpest by the simultaneous method. Allowing for all charges the four bulls will cost Rs. 12,000 landed at Madras.

The total cost of this part of the scheme may be estimated as follows :—

A. Capital Cost.

	Rs.
(1) Cost of four bulls landed at Madras ...	12,000
(2) Cost of four bull sheds	4,000
Total ...	16,000

B. Recurring.

Feeding charges, 150×4	600
Attendants, 15×12×4	720
Contingencies	200
Total ...	1,520

These charges would be doubled when eight bulls are kept.

9. It is not easy to estimate the cost of establishing a dairy and breeding farm. The cost of buildings on the Chintaladevi cattle farm is proving much higher than was originally anticipated. Judging by these, the initial cost of such a farm would not be less than two lakhs, while the annual recurring cost would be about Rs. 24,000, but this should of course be largely recouped by sale of milk and stock.

10. If this scheme is generally approved of, I request sanction for the purchase of four Ayrshire bulls this year. A lump provision of Rs. 14,000 has been made in the budget for 1919-20 under 26-A (*a*) Agriculture III (3) Experimental Farms and Cultivation.

The Madras Government in their order observe :—

The Government generally approve the proposals of the Director of Agriculture for the improvement of the dairy business in the Madras City and sanction the purchase during 1919 of four Ayrshire bulls. The Director is requested to consider and report on the question of the locality for the proposed dairy farm and to submit in due course plans and estimates for the buildings required in that connexion.

2. The attention of the Registrar of Co-operative Societies is invited to paragraph 7 (*f*) of the Director's letter and he is requested to consider and report, in consultation with the Agricultural Department, on the feasibility of starting co-operative dairy societies and societies for credit purposes among the milkmen in the City as well as in other parts of the Presidency.

EDUCATION.

More State Aid for Universities.

Mr. Fisher, President of the Board of Education, lectured in mail week at Saddlers' Hall, Cheapside, on "The Functions of Government in Relation to Education." The lecture was arranged by the Industrial Reconstruction Council and the Lord Mayor presided.

Mr. Fisher said that the change that would most seriously affect education would be to abolish the local system and have a system centralized in Whitehall, but of all the changes, he thought that was the least likely to occur. The English system of education was not a public system administered locally, like the American, nor a public system administered from a central office, like the German. It had not been framed upon a comprehensive and all including plan, and this complexion of affairs, corresponded more closely with the unanalysed feelings of the average Englishman, who was a born individualist and resented Government interference. They might fairly assume then that with the passing of the Education Act and the Superannuation Act last session, and the reforms in educational finance with which they were accompanied, they had now fixed for some years to come the main outlines of the educational landscape. Many years of strenuous effort, of devoted toil, and of enthusiastic adventure would be necessary before the provisions of the Act of 1918 became part of the flesh and blood of our national life, and it was greatly to be hoped that the cause of good administration would not be impeded by the intrusion of educational controversies which might paralyse action, deflect energy, and divide purpose.

He would not deny that the changes which had been accomplished since he came to the Board of Education two years ago had tended to increase the weight and power of the public as opposed to the private system of education in the country. More money had gone to the teachers, both in the way of salary and in the way of pension, larger grants had been procured for secondary and elementary schools, and it had consequently been made more difficult for the weaker schools, standing outside the State system, and depending upon voluntary contributions, to compete with the schools assisted out of public money. It was hoped that in the near future it might be found possible to increase Treasury grants

to the Universities, to extend encouragement to scientific research in all fruitful directions. Education would undoubtedly work better if the number of local authorities could be reduced, but the administration of more than 300 local bodies was a formidable obstacle to any undue prominence being given to any particular form of education.

AID OF VOLUNTARY AGENCIES.

The State was now about to attempt, under the provisions of the Education Act of last Session, to train the whole adolescent population of the country, but the period to be spent in the new continuation schools, being carved out of the precious hours assigned to industrial toil, would necessarily be short, and must be regarded as a stimulus to education of a voluntary kind rather than a sufficient provision in itself. The new Act would largely fail in its purpose unless supported by all weight which voluntary agencies, whatever their social or religious complexion, could bring to bear on an imporved moral, physical and intellectual condition of our young people.

We had now reached a point in educational development at which it became clear that the Universities would be compelled to accept a larger measure of State assistance than had hitherto been afforded to them to meet the needs in certain important branches of scientific development. For instance, trained meteorologists were needed for aviation purposes, trained marine physicists in connexion with submarines, and hydraulic engineers for the proper use of our waterways.

What was the solution to the many problems which presented themselves? He had come to the conclusion that it partly depended upon the intelligent co-operation of the universities themselves, but partly, he thought that itelligent co-operation must be assisted by the gentle and indirect pressure exercised by the distribution of Treasury grants to the universities willing to receive them; and it was his intention, in collaboration with the Secretaries for Scotland and Ireland, to set up a Committee which would distribute grants to universities in the administration of which there would be some opportunity to give counsel to the university as to a particular line of development in the pursuit of which they were most likely to contribute to the commonweal.

It was to be hoped that, in the new educational impulse that was running through this country, the drawbacks he had mentioned might disappear, and that they might witness, in the course of the next generation, the completion of a system of public education preserving all the best elements of their ancient freedom, but combining these with a higher measure of efficiency and a greater comprehension of the ... scientific needs of modern life.

FRUIT CULTURE.

Grafting the Grape-Vine.

Mr. H. V. Gole, Grape-Grower, Nasik, writing in the *Tropical Agriculturist* for March, 1919, says:—

Among other advantages of grafting the grape-vine, it is claimed that the effect of grafting is to produce a constant weakening of the scion with increased fructification, a greater number of closely-set bunches with large berries, more juicy and frequently richer in saccharine matter, and an early ripening. Husmann also believes that grafting increases fruitfulness, the temporary obstrnction seeming to have the effect upon the graft of making it produce more and finer fruit than on its own roots. He has also recorded similar experience of other eminent growers.

The matter seemed worthy of investigation and led me to undertake a few experiments as already remarked in Bulletin No. 71 (of 1915) of the Bombay Agricultural Department. The principal varieties of grapes grown at Nasik are only four. Bhokari, being a good cropper, is much in favour and largely grown, while Fakari, Sahibi, and Hafsi or Kali, being very shy bearers, are never grown beyond a few vines in a plantation, though these varieties are decidedly superior. If grafting produced increased fruitfulness, the problem here was to ascertain whether some of our shy bearers could be made to yield more and better fruit by grafting them on other stock.

I had no clear notions about the influence of the stock upon the scion. I vaguely imagined that Bhokari, being very prolific, might exert a favourable influence upon the scion. Also, as Fakari, Sahibi, and Kali are very vigorous growers, producing abundant foliage—perhaps at the expense of fruit—I should be able to check this habit of vigorous growth by selecting a stock which was a moderate grower by habit, such as Bhokari. On these considerations, I decided to use Bhokari as stock.

The next point was to select the method of grafting. Various methods of grafting and budding have been suggested. As I had very little experince in grafting, I chose to operate in four different manners, namely:—

(1) Grafted cuttings,
(2) Grafting by approach,
(3) Crown grafting, and
(4) Side-cleft grafting.

Grafted Cuttings.

For successful grafting it has been found that the temperature should not exceed 20° or 25°C. As cuttings could only be obtained in the beginning of October, I tried grafted cuttings at this time, though the temperature conditions were not favourable. All the trials failed successively for three years (1914 to 1916). In preparing the graft, the cut has to be made one-half to one inch above and below a node upon the stock and scion respectively. This left the knitting surface much too small. The grafted cuttings should have been kept for callusing in fresh moist sand before they were set to root. I admit that I had not followed this instruction. Be it from whatsoever cause, none of the grafted cuttings rooted, and I gave up the trials after three years.

Grafting by Approach.

In 1913 a *mali* from the Ganeshkhind Botanical Gardens, Kirkee, grafted on two Bhokari vines in one of my plantations, operating by the usual method of grafting by approach (tongue graft). Both the grafts knitted well and were successful. Fakari canes were used for scions. Both grafts were pruned in April, 1914, to form the head. One of the grafts was accidentally destroyed while ploughing. The other graft was again pruned for fruit in October, 1914. The stock of this graft is 40 in. long and the scion after heading in was 24 in. long. It gave six bunches of good size, while there were only four small bunches on the parent vine, that is, from which the scion was taken. The result was tolerably fair and encouraging. This graft is bearing splendidly every year.

I have found that grafting by approach is a much surer method—the grafts knit well and the chances of failure are few. I have other grafts prepared by the approach method. One is bearing fruit beautifully. The length of the stock is 24 in. and that of the scion after heading is 40 in. Three other grafts had to be transplanted elsewhere in April, 1917, as they happened to be in an isolated condition, but they have not as yet recovered from the shock.

But there is one disadvantage with this method. As the number of vines for the scion is only limited in a given plantation, only a few vines can be grafted by this method. I thought of trying a method which shall be quite independent of the position of scion vines, which is described below.

Crown Grafting and Side-cleft Grafting.

In October, 1914, I tried 10 crown grafts and 10 side-cleft grafts. Four crown grafts were put below the ground and the rest above the ground. Only one graft above ground knitted well and was successful. Again, in the following year, out of nine crown grafts and nine side-cleft grafts, only one crown graft above ground was successful. The trials in 1916 and 1917 failed to give even a single successful graft. From this it appears that crown and side-cleft grafting are much more difficult and cannot be practised as a general method.

So far my object had not been attained. I wanted to find out a method of grafting by which the variety of any existing plantation can be changed at will. A new plantation can be put up by growing together and training mixed cuttings of different varieties, and when the heads are formed, the choice variety may be grafted upon another stock by the approach method. I have obtained a few grafts in this manner. But it takes up much time to train the vines before they can be grafted upon and, therefore, foreign varieties cannot be propagated rapidly by this method, nor can their possibilities judged within a short time. Crown and side-cleft grafting have a greater significance in the case of untried and foreign varieties; for, by these methods, these varieties can be introduced rapidly and their possibilities judged.

Results.

As a general rule, Fakari vines on their own roots bear quite indifferently. They will not bear fruit at all or bear a few bunches which are quite out of proportion to the large bearing surface on the head of the vines. All the grafts are bearing fruit regularly from the second year. The quantity of fruit will depend on the bearing surface. As the age of the grafts advanced, the heads were well formed and the bearing surface had increased. There was a corresponding increase in the number of bunches and the weight of the fruit. I am writing this from my observations. I have not kept regular records. Last year the weight of fruit on the graft (approach graft of 1913,) must have been 15 lb.; the other approach grafts yielded nearly seven pounds of grafts bore quite to my expectation. This year the approach grafts of 1913, had 42 bunches, which weighed 22 lb. (Birds are responsible for considerable loss of weight; only actual weight is given.) The other approach grafts had 19 bunches which weighed 14lb. The number of bunches on the crown graft of 1914, was 17 and weighed 7½ lb., while the other crown graft of 1915 gave 13 bunches which weighed 6 lb. The bunches on both the grafts were mildewed, which circumstance has adversely influenced the weight. Many of the bunches were of large size. The berries attained normal size. On the other hand the berries on some bunches were undersized. Near each crown graft (close to it) is a companion or sister Bhokari vine which is also in bearing. In one of my plantations there are 150 Fakari vines on their own roots.

CO-OPERATION IN MYSORE.

Mr. R. Ranga Rao, Registrar of Co-operative Societies, in a paper to the Eighth Conference of Registrar of Co-operative Societies, says :—

The following statement compares the Progress of the Co-operative movement in Mysore during 1917-18 with that during 1916-17 :—

	Number of Societies	Membership	Share Capital	Deposits	Loans	Total Transactions	Net Profits	Reserve Fund
1916-17	974	75,000	25,00,000	17,50,000	12,00,000	2,15,20,000	2,63,000	2,35,000
1917-18	1,100	82,000	30,00,000	20,00,000	15,00,000	2,60,00,000	3,05,000	3,20,000

The rate of progress was below that of previous years. This was not due to the War which had scarcely any effect on the movement as a whole except to slight extent with regard to Weavers' Societies. The diminished rate of progress was due to greater attention being paid to consolidation of existing societies than to their expansion. Special measures were adopted for the recovery of loans. An examination was made of the principles on which loans were granted and recovered. As a tendency was noticed on the part of the Committee members of some of the Societies to monopolise loans, a rule was passed by the Government limiting the loans admissible to the Committee members of a Society to 25 per cent of the total loans granted by the Society. An investigation was instituted into the condition of the members of Co-operative Societies with a view to find out how far they had been benefitted by their membership. The investigation has been completed in only 40 Societies and the results, on the economic side, show that while the total indebtedness of the members has not meterially decreased, their total assets have substantially increased.

The following statement shows the varieties of Societies in Mysore :—

Primary non-agricultural credit Societies	70
Primary agricultural credit Societies	900
Central Banks, Unions, etc.	20
Societies for manure supply	3
,, the supply of agricultural implements	3
Societies for lift irrigation	2
,, sandal-wood carvers	2
,, ivory inlayers	2
,, toy-makers	2
,, weavers	22
,, rice hulling and jaggary making.	10
Stores	20
Grain Banks	25
House Building Societies	4
Societies for backward classes	15

It will be noticed from the statement that the bulk of the societies in Mysore are credit institutions. But there is general desire on the part of the people to apply co-operative principles to several agricultural and industrial purposes. Apart from the special societies mentioned in the statement above, many of the credit societies undertake the supply of manure, seed and agricultural implements to their members. So far, however, their efforts in these directions have not been specially successful nor fully organized. But the work has now been taken up and a considerable expansion of Agricultural and Industrial co-operation, side by side with the development of the credit movement may be soon expected.

The question of forming an Apex Provincial Co-operative Bank, which has been and is being discussed among co-operators all over India, was taken up in Mysore a little over two years ago. A Central Bank, which was started in 1908, was serving some of the purposes of an Apex Bank, but as it was considered to fall short in some respects of the ideals of a Provincial Bank, a new Apex Bank was started

some time ago. It received considerable encouragement on all sides and developed rapidly. As, however, it is distinctly inconvenient to have two Provincial Banks serving the same area and it leads to a waste of efforts, efforts are now being made to amalgamate the two under a suitable constitution.

The prominence given to the redemption of prior indebtedness forms a principal feature of the working of the agricultural credit societies in Mysore. Accurate figures are unfortunately not available, but out of a total credit of about 120 to 150 lakhs granted by these societies, about 50 lakhs have been utilized for the repayment of prior debts. With a view to still further increase this branch of their work, the societies are, as already stated, conducting a survey into the economic condition of their members. But the large amount of money required and the long period for which it will be required are likely to offer serious difficulties.

The Mysore Co-operative Societies Regulation, which was passed in 1905, was amended this year. The old regulation contained several provisions which were introduced into British India in 1912 and it has now been remodelled entirely on the lines of the British India Act of 1912.

The Staff of the Co-operative Department was recently revised and consists now of a Registrar, two Assistant Registrars, a Personal Assistant and an adequate number of clerks and inspectors. A third assistant Registrar will soon be added.

The seventh Mysore Provincial Co-operative Conference was held at Mysore in October, 1917. Also eight District and fifty Taluk Conferences were held during the year.

Among the improvements which it is proposed to introduce in the near future may be mentioned the formation of a non-official agency to take up the work of the Co-operative Education and propaganda, the training of men employed on Co-operative work, the creation of an audit and supervising staff paid for by the Societies themselves and the entrusting of village sanitation, village education and village improvement to Co-operative Societies. These subjects are under active consideration and early measures are likely to be adopted.

BOOKS IN BRIEF.

The War and Social Reform—*By W. B. Worsfold. John Murray, London. 6sh. net.*

It is gratifying to note that the number of books on the question of better relations between employers and employed is steadily increasing in England. The actual example of co-partnership in certain places and the need for increased out-put both in industries and agriculture may be held to be primarily responsible for the growing desire for a rapprochement between capital and labour. To whatever cause due, it is an encouraging sign of the times. Mr. Worsfold traces in this book the influence of war as a reforming agency, with special reference, we may add, to matters primarily affecting the wage-earning classes. His is a constructive book. He has no misgivings of the good effects of the Education Act of 1918 but he wants the nation to be prepared to meet the conditions that will be created by it in the years to come. "We must look to it in the immediate future," he writes, "to find work for the gifted children of the manual labourers, both skilled and unskilled, whom the Education Act, with other measures of social reform, will transfer in gradually increasing numbers to the ranks of the trained workers; and we must look to it, too, in the great consummation of the issues of the war, to remove the burden of those grosser bodily tasks which hitherto have oppressed the mind of the great majority of mankind, and robbed them of their due share in life's noblest pursuits." Mr. Worsfold, in a word, is a firm believer in the new Education Act. He speaks warmly of the spirit underlying it. "The principles and methods which it embodies are not new; its main features are drawn upon lines long familiar to workers in education. What is new is the national spirit which has made it possible to put such a measure upon the statute book at a time when our energies were so resolutely directed to the work of war." What is this new spirit he speaks of? It is, in one word, the affording the opportunity to the child of poor and rich alike, the benefits of education. Mr. Worsfold sees nothing but good in the participation of labour representatives in the administration of public affairs. He sees in it a sure sign of what is coming: the refashioning of English national life by forces not of destruction but of construction, thus adding to the strength of the body politic. In a chapter of great interest on social reform, Mr. Worsfold unfolds, what has been done and what yet remains to be accomplished. He ends it with a section on housing which we would recommend every one interested in the subject in this country to read. He calls it a "grave matter" and rightly so. The same question is forcing itself to the front in India and it requires attention at the hands of the Central Government in India so that it might start on a firm and sound basis. Mr. Worsfold believes—and we think rightly—that increased production and social reform can go together without detriment to each other. He has no doubts that science and

mechanical power can do much to save human labour. "Everything goes to show," he adds, "that the years immediately succeeding the war will inaugurate an era in which science and engineering skill will apply mechanical power to the service not alone of industrial production, but of men's everyday needs, with increasing variety and effect. Machinery will be purged of the reproach which William Morris brought against it. The utilisation of mechanical power and appliances will be directed consciously not to the saving of wages, but to helping the labourer to earn his wages; and thus employed it will raise the productive capacity of all human effort physical and mental." In the Appendix to his volume, Mr. Worsfold inserts an analysis of the *Cosmos* scheme of co-partnership of capital and labour, which is noticed below. He may be taken to view with favour the proposals adumbrated in *Cosmos* for his detailed examination of the scheme discloses more points of agreement than of disagreement with its author.

Industrial Situation After the War.—*Revised and Enlarged Edition. Harrison and Sons, St. Martins Lane, London, W. C. 2sh. net.*

The popularity of this memorandum issued under the auspices of the Garton Foundation is indicated by the rapidity with which the first issue (10,000 copies) was exhausted. The memorandum is, perhaps, the keenest analysis yet issued of the industrial situation to-day in Great Britain. Its constructive part aims at reconciliation between capital and labour without which increased production is impossible. It has been the object of the authors of the memorandum to keep always in mind the human as well as the economic side of industry. They are conscious that this country (Great Britain) has suffered much in the past from the habit of sectional thinking, which divides our national activities into water-tight compartments and regards the nation itself as composed of detached or hostile classes. The keener consciousness of corporate life, which is perhaps the most beneficial result of the present struggle, has created an atmosphere in which it is easier to conceive of industry as an inseparable part of the life of the nation; and of those concerned in industry, whether as employers or employed, as co-workers in the task of building up a future worthy of the sacrifices which have been made during the war." The memorandum itself fully bears out this conception of their duties. It is divided into five sections dealing with (1) the industrial situation to-day; (2) the effects of the war in the industrial situation; (3) the problem and some remedies; (4) the fundamental problem; and (5) joint industrial councils and trade boards. Under each head, the authors set out in dispassionate language what they deem necessary for a proper understanding of the existing situation and suggest remedies wherever necessary of a useful character. Whatever the merits of individual schemes of reconciliation between capital and labour, it cannot be denied that increased production, increased savings, and increased confidence are the keys to the present industrial situation. Production itself is dependent on friendly relation between employers and the employed and the need of the hour is a reconciliation between the two. The authors of the Memo show that such a reconciliation is possible and is necessary in the interests of the nation. Will those to whom the memorandum is primarily addressed listen to the advice given? That is the only point at issue.

Cosmos: A Scheme for Industrial Co-operation between Capital and Labour.—*Edited with an introduction by Douglas Sladen. Horace Cox: Breams Buildings, London, E. C.*

Whoever the author of this pamphlet—and he is known to be a "Great Coal-owner" he deserves praise for the constructive scheme he has put forward in it. It is a scheme that strikes us as being eminently fair to employers and employed. It is principally to be welcomed for the suggestions it contains for getting at the fundamental cause of all labour interest—antagonism between capital and labour. The author's scheme has obvious advantages to both parties and ought to be welcomed by all interested in ending labour troubles. If increased production is necessary in the coming years, some such scheme as this should be adopted by both parties. This has the merit of being both simple and serious. The spread of labour organizations in India is likely to be followed with conflicts in the future between the two arms of production in this country as well. It is good, therefore, that those wishing well of labour in India should keep close watch over the development of the co-partnership movement in Great Britain and, if possible, extend its benefits to this country at an earlier stage than has been possible in England. To social workers, we cannot recommend a better pamphlet than that we are writing of. It is written by a convinced believer in co-partnership and that is, perhaps, its highest merit.

RECENT PUBLICATIONS.

The Tragedy of Milk Production. *Being letters addressed to Members of the British Parliament and the Press, of invaluable use to the general public specially interested in child welfare. By Robert Wallace, Professor of Agriculture and Rural Economy; Edinburgh University. 8½×5½, 40 pp. Edinburgh. Oliver and Boyd. 6d.*

The Fiftieth Annual Co-operative Congress, 1918. *Held at the Central Hall, Liverpool. Edited by A. Whitehead. 8½×5¾, xxxvi.+880 pp. Manchester Co-operative Union.*

The Taxation of Capital. *By Sir Alfred W. Soward, C. B., and W. E. Willan, Solicitor. 8¾×5½, xvi.+408 pp. Waterlow. 18s. n.*

The Human Machine and Industrial Efficiency. *By Frederic S. Lee, Dalton Professor of Physiology, Columbia University, etc. 7½×5, vii.+119 pp. Longmans. 5s. n.*

Industrial Re-construction and the Metric System. *By Harry Alcock. 8½×5½, 8 pp. Decimal Association.*

Education Authorities' Hand-book. *A digest of the Education (Scotland) Acts, 1872 to 1918, with the text of the statutes and an account of the statutory powers and duties of education authorities and school management committees. By G. N. Morrison, 8¾×5¾, xv.+298 pp. W. Hodge. 10s. 6d.*

New Town. A Proposal in Agricultural, Industrial, Educational, Civic, and Social Re-construction. *Edited by W. R. Hughes. 7½×4¾, 141 pp. Dent. 2s. n.*